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(54) Title: FUNGICIDAL 1,3,4-OXADIAZINES AND 1,3,4-THIADIAZINES

(57) Abstract

Fungicidal 1,3,4-oxadiazines and 1,3,4-thiadiazines of general formula (I) are disclosed, wherein G¹ is -CR¹R⁷-, -(CHR¹CHR²CHR³)-, or -(CHR¹CHR²CHR³CHR⁴)-; G² is -O., -S., -S(O)-, -S(O)_{2.7}, or -NR²⁷-; G³ is -CR⁴R⁸-, -(CHR⁵CHR⁶)-, or -(CHR³CHR⁵CHR⁶)- or a direct bond; X is N or CR¹³; Y is N or CR¹³; and E, R⁹, and R¹⁰ are various groups.

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TITLE

FUNGICIDAL 1,3,4-OXADIAZINES AND 1,3,4-THIADIAZINES

This invention relates to heterocyclic thiadiazines
and related heterocycles useful as agricultural
fungicides and compositions containing them.

BACKGROUND OF THE INVENTION

U.S.S.R. patent 461,929 generically discloses oxadiazines of Formula i and ii

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wherein:

R¹, R³, R⁴, R⁵, and R⁶ are hydrogen, alkyls, carboxyalkyls, aminoalkyls, phenyl, substituted phenyls, pyridyls, quinolyls, furyls, or thienyls, and

 \mathbb{R}^2 is alkyl, substituted alkyl, phenyl, substituted phenyl, or heteroaryl.

U.S.S.R. 461,929 does not specifically name any of the compounds of the instant invention, nor is any utility for the compounds disclosed, in this patent.

SUMMARY OF THE INVENTION

This invention pertains to compounds of Formulae I,

II, III and IV including all geometric and stereoisomers, agriculturally-suitable salts thereof,
agriculturally-suitable metal complexes thereof,
compositions containing them and their use as
fungicides.

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5 wherein:

-G1-G2-G3- taken together with the attached atoms form a 5-8 membered ring, wherein $-G^{1}$ is $-CR^{1}R^{7}$ -; $-(CHR^{1}CHR^{2})$ -; $-(CHR^{1}CHR^{2}CHR^{3})$ -; or -(CHR1CHR2CHR3CHR4)-; $-G^2$ is -O; -S; -S(O); $-S(O)_2$ or $-NR^{27}$; . 10 $-G^3$ - is $-CR^4R^8$; - - (CHR⁵CHR⁶) -; - (CHR³CHR⁵CHR⁶) - or a direct bond; For example, $-G^1-G^2-G^3$ can be -CHR¹CHR²-S-CR⁴R⁸-, wherein -G¹- is $-(CHR^{1}CHR^{2})-$, $-G^{2}-$ is -S-, and $-G^{3}-$ is $-CR^{4}R^{8}-$. The directionality of the $-G^1-G^2-G^3$ linkage is defined as $-G^1-G^2-G^3-$ in compounds of Formulae I and III and $-G^3-G^2-G^1$ in compounds of Formulae II and IV. Therefore, for example, when $-G^{1}$ is $-(CHR^{1}CHR^{2})$ in a compound of 20 Formula I or III, then the carbon of the CHR² unit of $-G^{1}$ - is bonded to $-G^{2}$ -. In a compound

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of I	Formula	II	or	IV,	when	-G1-	is	- (CI	HR ¹ C	:HR ²),
the	carbon	of	the	CHF	≀¹ uni	t is	bor	nded	to	-G ² -

X is N or CR13;

Y is N or CR14;

- E is H; C₁-C₆ alkyl; C₃-C₇ cycloalkyl optionally substituted with 1-2 methyl; C₁-C₆ haloalkyl; C₁-C₆ alkylthio; C₁-C₆ alkoxy; C₁-C₆ haloalkoxy; or phenyl, phenoxy, phenylthio, phenylamino, phenylmethyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, 2-naphthalenyl, thienyl, furanyl or pyridyl each optionally substituted with R¹¹, R¹² and R²⁸;
 - R¹, R², R³, R⁴, R⁵, R⁶, R⁷ and R⁸ are each independently H; C₁-C₄ alkyl; C₁-C₄ haloalkyl, halogen, CO₂CH₃, CO₂CH₂CH₃, cyano or phenyl optionally substituted with R²⁵;

provided that

- (i) when $-G^{1-} = -CR^{1}R^{7-}$ and $-G^{3-} = -CR^{4}R^{8-}$, then at least one of R^{1} , R^{4} , R^{7} and R^{8} is hydrogen; in other words the maximum number of carbon atoms in $-G^{1-}G^{2-}G^{3-}$ with geminal disubstitution is one;
- (ii) the maximum number of optionally substituted phenyl substituents on $-G^1-G^2-G^3-$ is one;
- (iii) -G³- is other than a direct bond in compounds of Formulae III and IV; and
 - (iv) $-G^2-G^3$ is other than $-NR^{27}$ in compounds of Formulae I and II;
- R⁹, R¹⁰ and R¹³ are each independently H; halogen; cyano; hydroxy; C₁-C₆ alkyl; C₁-C₄ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkylsulfinyl; C₁-C₄ alkylsulfonyl; C₃-C₆ cycloalkyl optionally substituted with 1-2 methyl groups; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₄ alkenyl; C₂-C₄ haloalkenyl; C₂-C₄

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	alkenyloxy; C_2-C_4 alkynyl; C_2-C_4 alkynyloxy;
·	NR ²⁹ R ³⁰ ; or phenyl or phenoxy optionally
	substituted with R31; or
	R^9 and R^{13} , or R^{10} and R^{13} , or R^9 and R^{14} can be
	taken together to form $-(CH_2)_3-$, $-(CH_2)_4-$ or a
	fused benzene ring optionally substituted with
	R ³¹ ;
	R^{11} , R^{12} , R^{21} , R^{24} , R^{26} and R^{31} are each
	independently halogen; C1-C4 alkyl; C1-C4
	haloalkyl; C_1-C_4 alkoxy; or C_1-C_4 haloalkoxy;
•	R ¹⁴ is H; halogen; C ₁ -C ₂ alkyl; or C ₁ -C ₂ alkoxy;
	R^{15} , R^{16} , R^{17} , R^{18} , R^{29} and R^{30} are each
	independently H or C1-C2 alkyl; or
	\mathbb{R}^{15} and \mathbb{R}^{16} , or \mathbb{R}^{17} and \mathbb{R}^{18} , or \mathbb{R}^{29} and \mathbb{R}^{30} can be
	taken together along with the nitrogen atom to
	which they are attached to form a
	4-morpholinyl, pyrrolidinyl or piperidinyl
	ring:
	R^{20} and R^{27} are each independently H; C_1-C_4 alkyl;
·	C ₁ -C ₄ haloalkyl; C ₂ -C ₅ alkylcarbonyl; phenyl-
• •	carbonyl optionally substituted with R21; C3-C4
	alkenyl; C3-C4 alkynyl; phenylmethyl optionally
	substituted with R^{21} on the phenyl ring; C_1-C_4
	alkylsulfinyl; C1-C4 alkylsulfonyl; phenyl-
	sulfinyl, phenylsulfonyl or phenoxycarbonyl
	each optionally substituted with R21; C2-C4
	alkoxycarbonyl; C(=0)NR ²² R ²³ ; C(=S)NHR ²³ ;
	$P(=S) (C_1-C_4 \text{ alkoxy})_2; P(=O) (C_1-C_4 \text{ alkoxy})_2; or$
	$S (=0)_2 NR^{22}R^{23};$
	R^{22} is H or C_1 - C_3 alkyl;
٠.•	R ²³ is C ₁ -C ₄ alkyl; or phenyl optionally
. · •	substituted with R24; or
•	\mathbb{R}^{22} and \mathbb{R}^{23} can be taken together along with the
	nitrogen atom to which they are attached to

form a 4-morpholinyl, pyrrolidinyl, piperidinyl

or imidazolyl ring;

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 R^{25} is 1-2 halogen; C_1-C_4 alkyl; C_1-C_4 haloalkyl; C_1-C_4 alkoxy; C_1-C_4 haloalkoxy; nitro; cyano or C_1-C_4 alkylthio;

R²⁸ is halogen; cyano; nitro; hydroxy;
hydroxycarbonyl; C₁-C₆ alkyl; C₃-C₆ cycloalkyl;
C₁-C₆ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkylsulfinyl; C₁-C₄ alkylsulfonyl; (C₁-C₄ alkyl)3silyl; C₂-C₅ alkylcarbonyl; C₂-C₄ alkenyl; C₃-C₄
alkenyloxy; C₂-C₄ alkynyl; C₃-C₄ alkynyloxy;
C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₅ alkoxycarbonyl; C₂-C₄ alkoxyalkoxy; NR¹⁵R¹⁶; C(=0)NR¹⁷R¹⁸; or phenyl,
phenoxy or phenylthio each optionally
substituted with R²⁶;

provided that

when E is, C_1 - C_6 alkylthio, C_1 - C_6 alkoxy, C_1 - C_6 haloalkoxy, phenoxy, phenylthio or phenylamino, then E may only substitute compounds of Formula I.

In the above recitations, the term "alkyl", used either alone or in compound words such as "alkylthio" or "haloalkyl" denotes straight-chain or branched alkyl; e.g., methyl, ethyl, n-propyl, i-propyl, or the different butyl, pentyl or hexyl isomers.

"Alkenyl" denotes straight-chain or branched alkenes; e.g., 1-propenyl, 2-propenyl, 3-propenyl and the different butenyl, pentenyl and hexenyl isomers.

"Alkenyl" also denotes polyenes such as 1,3-hexadiene and 2,4,6-heptatriene.

"Alkenyloxy" denotes straight-chain or branched alkenyloxy moieties. Examples of alkenyloxy include H₂C=CHCH₂O, (CH₃)₂C=CHCH₂O, (CH₃) CH=CHCH₂O, (CH₃) CH=C (CH₃) CH₂O and CH₂=CHCH₂CH₂O.

"Alkynyl" denotes straight-chain or branched
35 alkynes; e.g., ethynyl, 1-propynyl, 3-propynyl and the
different butynyl, pentynyl and hexynyl isomers.

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"Alkynyl" can also denote moieties comprised of multiple triple bonds; e.g., 2,7-octadiyne and 2,5,8-decatriyne.

"Alkynyloxy" denotes straight-chain or branched alkynyloxy moieties. Examples include HC=CCH₂O, CH₃C=CCH₂O and CH₃C=CCH₂O.

"Alkylthio" denotes branched or straight-chain alkylthio moieties; e.g. methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers.

Examples of "alkylsulfonyl" include CH₃SO₂, CH₃CH₂SO₂, CH₃CH₂CH₂SO₂, (CH₃)₂CHSO₂ and the different butylsulfonyl, pentylsulfonyl and hexylsulfonyl isomers.

"Alkylsulfinyl" denotes both enantiomers of an alkylsulfinyl group. For example, CH₃SO, CH₃CH₂SO, CH₃CH₂SO, (CH₃)₂CHSO and the different butylsulfinyl, pentylsulfinyl and hexylsulfinyl isomers.

"Alkoxy" denotes, for example, methoxy, ethoxy, n-propyloxy, isopropyloxy and the different butoxy, pentoxy and hexyloxy isomers.

"Cycloalkyl" denotes, for example, cyclopropyl, cyclobutyl, cyclopentyl, and cyclobexyl.

The term "halogen", either alone or in compound
words such as "haloalkyl", denotes fluorine, chlorine,
bromine or iodine. Further, when used in compound
words such as "haloalkyl", said alkyl may be partially
or fully substituted with halogen atoms which may be
the same or different. Examples of "haloalkyl" include
f30 F3C, C1CH2, CF3CH2 and CF3CF2. Examples of "haloalkenyl" include (C1)2C=CHCH2 and CF3CH2CH=CHCH2.
Examples of "haloalkynyl" include HC=CCHC1, CF3C=C,
CCl3C=C and FCH2C=CCH2. Examples of "haloalkoxy"
include CF3O, CCl3CH2O, CF2HCH2CH2O and CF3CH2O.

The total number of carbon atoms in a substituent group is indicated by the "C₁-C_j" prefix where i and j

are numbers from 1 to 8. For example, C_1-C_3 alkylsulfonyl designates methylsulfonyl through propylsulfonyl; C_2 alkoxyalkoxy designates CH_3OCH_2O ; C_3 alkoxyalkoxy designates, for example, $CH_3OCH_2CH_2O$ or

- 5 CH₃CH₂OCH₂O; and C₄ alkoxyalkoxy designates the various isomers of an alkoxy group substituted with a second alkoxy group containing a total of 4 carbon atoms, examples including CH₃CH₂CH₂OCH₂O, and CH₃CH₂OCH₂CH₂O. Examples of "alkoxyalkyl" include CH₃OCH₂, CH₃OCH₂CH₂,
- 10 CH₃CH₂OCH₂, CH₃CH₂CH₂CH₂OCH₂ and CH₃CH₂OCH₂CH₂. Examples of "alkoxycarbonyl" include CH₃OC(=O), CH₃CH₂OC(=O), CH₃CH₂OC(=O), CH₃CH₂CH₂OC(=O), (CH₃)₂CHOC(=O) and the different butoxy-, pentoxy- or hexyloxycarbonyl isomers.

Preferred for reasons of greatest fungicidal activity and/or ease of synthesis are

1. Compounds of Formula I wherein:

Y is N;

- E is phenyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, thienyl, or pyridyl each optionally substituted with R¹¹, R¹² and R²⁸;
- R¹, R², R³, R⁴, R⁵, R⁶, R⁷ and R⁸ are each independently H or methyl;
- R¹¹ and R¹² are each independently F, Cl, methyl, trifluoromethyl, methoxy or trifluoromethoxy;

R¹³ is H;

- R⁹ and R¹⁰ are each independently halogen; C₁-C₄ alkyl; cyclopropyl; C₁-C₄ haloalkyl; allyl; or C₂-C₃ alkynyl; or
- R^9 and R^{13} can be taken together to form a fused benzene ring optionally substituted with R^{31} ;
- R²⁸ is halogen; cyano; C₁-C₄ alkyl; C₁-C₄ haloalkyl; allyl; propargyl; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; or phenyl or

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phenoxy each optionally substituted with R26: R31 is halogen; C1-C4 alkyl or C1-C4 haloand agriculturally-suitable metal complexes thereof. 2. Compounds of Formula III wherein: Y is N E is phenyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, thienyl, or pyridyl each 10 optionally substituted with R11, R12 and R²⁸ R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 and R^8 are each independently H or methyl; R9 and R10 are each independently halogen; 15 C₁-C₄ alkyl; cyclopropyl; C₁-C₄ haloalkyl; allyl; or C2-C3 alkynyl; or R9 and R13 can be taken together to form a fused benzene ring optionally substituted with R31; 20 R11 and R12 are each independently F, Cl, methyl, trifluoromethyl, methoxy or trifluoromethoxy; R¹³ is H: R²⁰ is H; R²⁷ is H; C₁-C₄ alkyl; C₂-C₅ alkoxycarbonyl; C3-C4 alkenyl or C3-C4 alkynyl; R²⁸ is halogen; cyano; C₁-C₄ alkyl; C₁-C₄ haloalkyl; allyl; propargyl; C1-C4 alkoxy; C1-C4 haloalkoxy; or phenyl or phenoxy each optionally substituted with R²⁶, R^{31} is halogen; C_1-C_4 alkyl or C_1-C_4 halo-ी रहा हा के की नहीं गानिका alkyl; and agriculturally-suitable metal complexes 35 thereof.

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3. Compounds of Preferred 1 wherein:

 G^2 is 0; S or NR^{27} ;

E is phenyl optionally substituted with R¹¹,
R¹² and R²⁸; indanyl or tetrahydronaphthalenyl; and agriculturally-suitable
metal complexes thereof.

4. Compounds of Preferred 3 wherein:

 G^2 is O; S; NH or N(C₁-C₄ alkyl);

E is phenyl optionally substituted with R^{11} , R^{12} and R^{28} ; and agriculturally-suitable metal complexes thereof.

Specifically preferred for greatest fungicidal activity and/or ease of synthesis are:

3-(4,6-dimethyl-2-pyrimidinyl)-3,6-dihydro-5-phenyl-2H-1,3,4-oxadiazine

3-(4,6-dimethyl-2-pyrimidinyl)-5-(4-ethylphenyl)-3,6-dihydro-2H-1,3,4-oxadiazine

20 2-(2-chlorophenyl)-4-(4,6-dimethyl-2pyrimidinyl)-5,6-dihydro-4H-1,3,4-thiadiazine

4-(4,6-dimethyl-2-pyrimidinyl)-2-(4-ethylphenyl)-5,6-dihydro-4H-1,3,4-thiadiazine

25 DETAILED DESCRIPTION OF THE INVENTION

Compounds of Formula I wherein E is as described in the Summary of the Invention except that E is not phenoxy, phenylthio, phenylamino, C_1-C_6 alkoxy, C_1-C_6 alkylthio and C_1-C_6 haloalkoxy can be prepared by one or more of the methods described in Equations 1-6 and 13.

Compounds of Formula 2 in Equation 1 can be prepared by reacting hydrazine 1 with an acid chloride and a base such as pyridine or triethylamine at 0°C in a solvent such as dichloromethane, THF, or pyridine (Equation 1). The hydrazines 1 are known in the

literature (*J. Pest. Sci.*, 1990, 15, 13) and can be prepared by one skilled in the art as taught in EP 293,743-A and by Naito et al. in *Chem. Pharm. Bull.*, 1969, 17, 1467.

5 Equation 1

Compounds of Formula 4 can be prepared by treatment of hydrazides of Formula 2 with P₂S₅ in pyridine at reflux for 1-2 h to form thiohydrazides of Formula 3, followed by reaction with an appropriate alkylating agent, wherein L can be Cl, Br, I or tosylate, in the presence of two equivalents of base, such as triethylamine (Equation 2). In some cases, additional base such as sodium hydride is necessary to induce cyclization. The cyclization reaction is typically performed at 25° to 100°C in an inert aprotic solvent such as THF or acetonitrile.

20 Equation 2

Compounds of Formula 5 can be prepared similarly by treatment of hydrazides of Formula 2 with an alkylating

agent and two equivalents of base using the cyclization procedure previously described for the preparation of compounds of Formula 4 (Equation 3).

Equation 3

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Compounds of Formula 7 can be prepared by the reaction of hydrazines of Formula 1 with ketones of

Formula 6 in a solvent such as acetonitrile, dichloromethane or acetic acid. The desired heterocycles of Formula 8 can be formed by treatment of the resulting product with a ketone or aldehyde in the presence of a catalytic amount of acid such as butanesulfonic acid (Equation 4). This reaction is typically conducted at 25° to 100°C in an anhydrous organic solvent such as THF or acetonitrile for 12 to 24 h.

Equation 4

Compounds of Formula 6 wherein m=1 and Q=0 can be prepared by α-hydroxylation of a methyl ketone with iodosobenzene as described by Moriarty et al. in Tetrahedron Lett., 1981, 22, 1283.

Thiols of Formula 7b and amines of Formula 7c can be prepared as outlined in Equation 5. Alcohols of Formula 7a (Q=0) can be converted to the corresponding mesylate by methods known in the art. The mesylates can be treated with sodium sulfide to form the thiols 7b, or they can be reacted with potassium phthalimide and then hydrazine to form amines of Formula 7c.

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7c

Equation 5

Formation of heterocycles of Formula 9 can be accomplished by treatment of hydrazones of Formula 7 with the appropriate alkylating agent as previously described for the preparation of heterocycles of Formula 4 (Equation 6).

Compounds of Formula I wherein E is phenoxy, phenylthio, phenylamino, C_1 - C_6 alkoxy, C_1 - C_6 alkylthio or C_1 - C_6 haloalkoxy can be prepared by one or more of the methods described in Equations 7-13.

Heterocycles of Formula 11 can be prepared by
treating methylthio-substituted compounds of Formula 10
with various nucleophiles in the presence of a base.
Suitable nucleophiles can be optionally substituted
phenols, thiophenols, or anilines, C₁-C₆ alkylthiols,
C₁-C₆ alcohols and C₁-C₆ halo-substituted alcohols
(Equation 7).

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Nu = optionally substituted phenol, thiophenol, or aniline; C_1-C_6 alkylthiol; C_1-C_6 alcohol, C_1-C_6 halo-substituted alcohol

n = 0, 1, 2, 3

 $Q = 0.5, N-R^{27}$

 $R, R^a, R^b = R^1, R^2, R^3, R^4, R^7$

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The methythio-substituted heterocycles of Formula 10 can be synthesized by reaction of carbazates of Formula 12 with an alkylating agent in the presence of two equivalents of base, such as triethylamine

15 (Equation 8). This type of cyclization was described previously for the preparation of compounds of Formula 4 (Equation 2). Compounds of Formula 12 are known in the literature and can be prepared by one skilled in the art (e.g., see G. W. Stacy, "Heterocyclic Compounds," R. C. Elderfield, ed., Wiley, NY, 1961, vol. 7, p 835).

5 Alternatively, compounds of Formula 10a can be prepared by sequential treatment of carbazates of Formula 13 with F₂S₅ and iodomethane in pyridine (Equation 9). Carbazates of Formula 13 are known in the literature (e.g., see Dox, J. Am. Chem. Soc., 1926, 10 48, 1951).

Equation 9

 $R, R^{a}, R^{b}=R^{1}, R^{2}, R^{3}, R^{4}, R^{7}$

Methylthio-substituted heterocycles of Formula 15 can be prepared by treating hydrazides of Formula 14 with P_2S_5 in pyridine at reflux and then alkylating the resulting thio derivative with iodomethane in the presence of a base such as triethylamine (Equation 10).

Reaction of compounds of Formula 15 with nucleophiles and base, as previously described for the preparation of compounds of Formula 11 in Equation 7, yields products of Formula 16. The seven-membered ring analogs, compounds of Formula 17, can be prepared from hydrazides of Formula 14a by the same procedure (Equation 10).

Equation 10

 $m = 1,2,3; Q = 0, S, N+R^{27}; R^{C}, R^{d} = R^{3}, R^{4}, R^{5}, R^{6}, R^{8}$

Q=0, S, NR²⁷

Treatment of hydrazides of Formula 19 with an aldehyde or ketone in the presence of a catalytic amount of acid, such as butanesulfonic acid, yields heterocycles of Formula 14 (Equation 11). The cyclization is typically performed at 25° to 100°C in

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an anhydrous organic solvent such as THF or acetonitrile.

Equation 11

Compounds of Formula 19a (Q=O) can be synthesized by condensing hydrazine 1 with hydroxyacids of Formula 18 in the presence of a dehydrating agent such as dicyclohexylcarbodiimide in an inert aprotic solvent such as THF or dichloromethane. Hydroxyacids of Formula 18 are well-known to one skilled in the art. Thiols of Formula 19b (Q=S) and amines of Formula 19c (Q=NR²⁷) can be prepared by forming the mesylate of alcohols of Formula 19a followed by displacement with nucleophiles in a manner similar to that previously described for the preparation of compounds of Formulae 7b and 7c (Equation 5).

Compounds of 14a-can be prepared by treatment of hydrazides of Formula 19d (m=1) with the appropriate alkylating agent, as illustrated in Equation 12, according to procedures described above (see Equations 2 and 3).

Compounds of Formula Ib wherein G² is S(0) or S(0)₂ can be prepared from the corresponding thio analogue Ia by well-known methods for oxidation of sulfur (Equation 13). Typical reagents for this type of oxidation include m-chloroperoxybenzoic acid, hydrogen peroxide, sodium metaperiodate, and OXONE® (potassium peroxymonosulfate).

Equation 13

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Compounds of Formula II can be prepared by one or more of the following methods described in Equations 14-19.

Hydrazides of Formula 22 can be synthesized by the 20 reaction of hydrazine 21 with an acid chloride of

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Formula 20 in the presence of a base such as triethylamine or pyridine (Equation 14). Typical solvents for this reaction are dichloromethane and THF. Equation 14

The acid chloride of Formula 20 can be prepared by treatment of the corresponding carboxylic acid with thionyl chloride. Methods for preparing acid chlorides from carboxylic acids are well-known in the literature.

Procedures for preparing pyrimidine carboxylic acids are described by Sakamoto, T., and Yamanaka, H. in Heterocycles, 1981, 15, 583.

Heterocycles of Formula 24 can be prepared by treating hydrazides of Formula 22 with P₂S₅ in pyridine at reflux to form the thiohydrazides of Formula 23, followed by reaction of 23 with an alkylating agent in the presence of two equivalents of base such as triethylamine (Equation 15). Typically, these reactions are conducted at 25° to 100°C in an inert aprotic solvent such as THF or acetonitrile.

5 Compounds of Formula 25 can be prepared similarly by treatment of hydrazides of Formula 22 with an alkylating agent and two equivalents of base according to the previously described cyclization procedure (Equation 16).

10 Equation 16

Compounds of Formula 28 can be synthesized by the reaction of hydrazines of Formula 21 with ketones of Formula 26 in a solvent such as dichloromethane or acetonitrile to form hydrazones of Formula 27 (Equation 17). The hydrazone can then be treated with a ketone

or aldehyde in the presence of a catalytic amount of acid, such as butanesulfonic acid, to form cycloadducts of Formula 28. This reaction is typically carried out at 25° to 100°C in an anhydrous organic solvent such as THF or acetonitrile.

Equation 17

Hydroxyketones of Formula 26a (Q=0, m=1) can be prepared by α-hydroxylation of the corresponding methyl ketone 29 with iodosobenzene as described by Moriarty et al. in Tetrahedron Lett., 1981, 22, 1283, and illustrated in Equation 18. Methods to prepare heteroaryl ketones of Formula 29 are well-known in the art. The corresponding thiols of Formula 26b (Q=S) and amines of Formula 26c (Q=NR²⁷) can be prepared by methods previously described for thiols and amines of Formulae 7b and 7c, respectively (Equation 5).

5 Compounds of Formula IIb can be synthesized from the corresponding thio analogue of Formula IIa by oxidation (Equation 19). Typical reagents for this type of oxidation include m-chloroperoxy benzoic acid, hydrogen peroxide, sodium metaperiodate, and OXONE® (potassium peroxymonosulfate).

Equation 19

15 Compounds of Formulae IIIa and IVa can be prepared by reduction of compounds of Formulae I and II, respectively, with sodium borohydride/titanium (IV) chloride according to the procedure taught by Kano et al. in Synthesis, 1980, 695, and set forth in Equation 20. In cases where substituents in compounds of Formulae I and II are not compatible with the reduction conditions, protection and deprotection techniques, which are well-known in the art may be employed.

Compounds of Formulae IIIa and IVa can be capped on nitrogen with various substituents (R²⁰) by treating with the appropriate alkylating, acylating, sulfonylating or phosphonylating agent of Formula 30 as shown in Equation 21. The leaving group (Lg) in compounds of Formula 30 may be Cl, Br, I, acetate or other moeity known to act as a leaving group.

Typically, these reactions are run in inert solvents such as THF, benzene or dichloromethane in the presence of a tertiary amine base, such as triethylamine, at a temperature ranging from 0° to 100°C.

Equation 21

Compounds of Formula IIIb and IVb wherein R²⁰ is

5 C(=0)NR²²R²³ or C(=S)NHR²³ can be prepared by treating compounds of Formulae IIIa or IVa with an isocyanate or isothiocyanate by methods well-known in the art (Equation 22). Typical solvents for this type of reaction are THF, acetonitrile and dichloromethane.

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Equation 22

IIIa + W=C=N-R²²

$$R^{20} = H$$
 W = 0, S

 R^{9}
 R^{10}
 $R^{20} = H$ W = 0, S

 R^{9}
 R^{10}
 R^{10}

Compounds of Formula 3, as illustrated in Equation 2, can also be prepared by reacting hydrazine 1 with the appropriate carboxymethyl dithioate 31 in aqueous sodium hydroxide at 25°C (Equation 23). Carboxymethyl dithioates are known in the literature and can be prepared by one skilled in the art (see Jensen, K. A. and Pedersen, C., Acta Chemica Scandinavica, 1961, 15, 1087).

15 Equation 23

Likewise, thiohydrazides of Formula 23, as 20 illustrated in Equation 15, can be synthesized by reaction of a hydrazine of Formula 21 with a carboxy-methyl dithioate of Formula 32 in aqueous sodium hydroxide (Equation 24).

Equation 24

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Compounds of Formula 11, wherein E is phenoxy or phenylthio, can also be synthesized by treating a

10 hydrazine of Formula 1 with phenyl-chlorothionoformate or phenyl-chlorodithioformate of Formula 33 to form a thiocarbazate hydrochloride of Formula 34 (Equation 25). This type of reaction is typically run in a solvent such a methylene chloride from about -10°C to 0°C. The cyclization is performed by treating 39 with the appropriate alkylating agent in a solvent mixture of aqueous sodium hydroxide and THF at 25°C.

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Equation 25

n=0,1,2,3 R,R^a,R^b=R¹,R²,R³,R⁴,R⁷ L=C1,Br,I,OTs

The metal complexes of compounds of Formulae I-IV of the instant invention include complexes with copper, zinc, iron, magnesium, or manganese. These complexes can be formed by combining the compound of Formulae I-IV with the metal salt in either aprotic solvents, such as ether or THF, or protic solvents, such as methanol. EP-A-459,662 discloses metal complexes of other nitrogen containing compounds as agricultural fungicides.

EXAMPLE 1

Preparation of 1-(4-ethylphenyl)-2-hydroxyethanone(4.6-dimethyl-2-pyrimidinyl)hydrazone

To a solution of 3.57 g (21.7 mmol) of p-ethyl-2-hydroxyacetophenone in 100 mL of acetonitrile was added 3.00 g (21.7 mmol) of 4,6-dimethyl-2-hydrazinopyrimi-

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dine, 3Å molecular sieves, and a catalytic amount of butanesulfonic acid. The reaction mixture was stirred overnight at room temperature and then diluted with dichloromethane and chloroform. The organic phase was washed successively with saturated sodium bicarbonate and brine, dried over sodium sulfate, filtered and concentrated. The crude product was passed through a plug of silica gel and triturated with hexanes to yield 3.45 g of product. ¹H NMR (CDCl₃) & 10.65 (bs, 1H), 7.61 (d, 2H), 7.15 (d, 2H), 6.47 (s, 1H), 6.10 (bs, 1H), 4.86 (s, 2H), 2.64 (q, 2H), 2.38 (s, 6H), 1.22 (t, 3H).

EXAMPLE 2

Preparation of 3-(4,6-dimethyl-2-pyrimidinyl)-5-(4-ethylphenyl)-3,6-dihydro-2H-1,3,4-oxadiazine

A solution of 1.00 g (3.52 mmol) of 1-(4-ethyl-phenyl)-2-hydroxyethanone(4,6-dimethyl-2-pyrimidinyl)-hydrazone, 0.21 g (7.04 mmol) of paraformaldehyde, and a catalytic amount of butanesulfonic acid was heated at reflux for 3 h in 20 mL of acetonitrile. After cooling, the reaction mixture was diluted with dichloromethane and chloroform. The organic phase was washed successively with saturated sodium bicarbonate and brine, dried over sodium sulfate, filtered and concentrated. Chromatography on silica gel gave 70 mg of desired product as a gum. ¹H NMR (CDCl₃) δ 7.66 (d, 2H), 7.21 (d, 2H), 6.56 (s, 1H), 5.54 (s, 2H), 4.81 (s, 2H), 2.67 (q, 2H), 2.42 (s, 6H), 1.24 (t, 3H).

EXAMPLE 3

Preparation of 4-ethylbenzoic acid 2-(4.6-dimethyl-2-pyrimidinyl)hydrazide

4,6-Dimethyl-2-hydrazinopyrimidine (3.72 g, 26.95 mmol) was suspended in 80 mL of pyridine and the reaction mixture was cooled to 10°C. After slowly adding p-ethylbenzoyl chloride (5.00 g, 29.66 mmol), the reaction mixture was allowed to warm to room

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temperature over 1 h. Addition of ice and water precipitated the product which was filtered and washed with hexanes to yield 6.85 g of a white solid. mp 118-119°C. ¹H NMR (CDCl₃) δ 9.15 (bs, 1H), 7.8 (d, 2H), 7.35 (bs, 1H), 7.2 (d, 2H), 6.52 (s, 1H), 2.7 (q, 2H), 2.33 (s, 6H), 1.23 (t, 3H).

EXAMPLE 4

Preparation of 4-(4,6-dimethyl-2-pyrimidinyl)-2-(4ethylphenyl)-5.6-dihydro-4H-1.3.4-thiadiazine

A solution of 5.30 g (18.52 mmol) of 4-ethylbenzoic acid 2-(4,6-dimethyl-2-pyrimidinyl) hydrazide and 6.18 g (13.89 mmol) of P_2S_5 in 60 mL of pyridine was heated at reflux for 1.5 h. After cooling, water was added and the reaction mixture was heated briefly at reflux to 15 quench the reaction. The mixture was then cooled with an ice bath to precipitate the product. The solid was filtered and washed with water to give 6.57 g (21.73 mmol) of thiohydrazide which was then dissolved in 100 mL of THF with 7.5 mL (54.33 mmol) of triethylamine and 2.1 mL (23.91 mmol) of 1,2-dibromoethane. The reaction mixture was heated at reflux overnight. After cooling, water and ether were added and the organic phase was separated and washed with brine. organic extracts were dried over magnesium sulfate, filtered and concentrated. The crude product was passed through a plug of silica gel to give 200 mg of product as an oil. ¹H NMR (CDCl₃), 7.8 (d, 2H), 7.2 (d, 2H), 6.53 (s, 1H), 4.45 (m, 2H), 3.35 (m, 2H), 2.67 (q, 2H), 2.41 (s, 6H), 1.22 (t, 3H).

EXAMPLE: 5

Preparation of 4-(4,6-dimethyl-2-pyrimidinyl)-5,6dihydro-2-(3-methylphenyl)-4H-1.3,4-oxadiazine

A solution of 1.00 g (3.89 mmol) of 3-methylbenzoic acid 2-(4,6-dimethyl-2-pyrimidinyl)hydrazide, 0.37 mL (4.28 mmol) of 1,2-dibromoethane, and 1.33 mL (8.95 mmol) of DBU in 20 mL of dry THF was heated at

reflux overnight. After cooling, 2.3 equivalents (8.95 mmol) of sodium hydride and 0.37 mL (4.28 mmol) of 1,2-dibromoethane were added, and the reaction mixture was heated at reflux overnight. The mixture was allowed to cool to room temperature and saturated aqueous ammonium chloride was added. The product was extracted with dichloromethane and chloroform and the organic phase was washed with brine. The organic extracts were dried over sodium sulfate, filtered, concentrated, and passed through a plug of silica gel to give 100 mg of desired product as a gum. $(CDCl_3)$ δ 7.82 (m, 1H), 7.75 (m, 1H), 7.25 (m, 1H), 7.19 (m, 1H), 6.49 (s, 1H), 4.54 (m, 2H), 4.28 (m, 2H), 2.42 (s, 6H), 2.38 (s, 3H).

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EXAMPLE 6

Preparation of 4-methoxybenzenecarbothioic acid O-[2-(4,6-dimethyl-2-pyrimidinyl)hydrazide

4,6-Dimethyl-2-hydrazinopyrimidine (p-methoxy-thiobenzoylthio) acetic acid (2.00 g), 14.49 mmol) and p-methoxyphenylcarboxymethyldithioate (3.48 g, 14.4 mmol) were dissolved in 20 mL of 1N aqueous sodium hydroxide and 10 mL of water. The reaction mixture was stirred at 25°C for 16 h and then acidified with 1N HCl. The resultant precipitate was filtered, washed with water, and dried under vacuum to give 3.22 g (11.2 mmol, 78%) of the title hydrazide as a white solid, m.p. 212-215°C ¹H NMR (CDCl₃) δ 9.5 (bs, 1H), 7.85 (d, 2H), 6.95 (d, 2H), 6.57 (s, 1H), 3.87 (s, 3H), 2.39 (s, 6H).

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EXAMPLE 7

Preparation of 4-(4.6-dimethyl-2-pyrimidinyl)-5.6-dihydro-2-phenyl-4H-1.3.4-thiadiazine

Benzenecarbothioic acid O-[2-(4,6-dimethyl-2-pyrimidinyl)]hydrazide (0.500 g, 1.94 mmol),

triethylamine (4.85 mmol, 0.67 mL) and 1,2-dibromoethane (0.44 g, 2.33 mmol) were dissolved in

10 mL of THF and heated at reflux for 5 h. After cooling, water was added and the mixture was extracted with ethyl acetate. The organic layer was washed with brine, dried over sodium sulfate, filtered and concentrated. The product was purified by flash chromatography on silica gel to yield 0.490 g (1.73 mmol) of a solid in 89% yield, m.p. 138-142°C. ¹H NMR (CDCl₃) & 7.88 (m, 2H), 7.37 (m, 3H), 6.55 (s, 1H), 4.47 (m, 2H), 3.36 (m, 2H), 2.42 (s, 6H).

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EXAMPLE 8

Preparation of 4-(4.6-dimethyl-2-pyrimidinyl)-2-(4-ethylphenyl)-5.6-dihydro-4H-1.3.4-thiadiazine 1-oxide 4-(4,6-Dimethyl-2-pyrimidinyl)-2-(4-ethylphenyl)-5,6-dihydro-4H-1,3,4-thiadiazine (0.800 g, 2.56 mmol) was dissolved in 10 mL of methanol and 2.5 mL of water. Sodium metaperiodate (0.600 g, 2.82 mmol) was added and

Sodium metaperiodate (0.600 g, 2.82 mmol) was added and the reaction mixture was heated at reflux for 1 h. Ethanol (2.5 mL) was added and heating was continued for 1 h more. The reaction mixture was then stirred at 25°C for 16 h. An additional 200 mg of sodium meta-

periodate was added and the mixture was heated at reflux for 1 h. The reaction mixture was washed with water and extracted with methylene chloride. The organic layers were washed with brine, dried over sodium sulfate, and concentrated. The crude product

was passed through a plug of silica gel to give 760 mg (91% yield) of a white solid, m.p. 149-164°C. ¹H NMR (CDCl₃) δ 7.95 (d, 2H), 7.28 (d, 2H), 6.7 (s, 1H), 5.45 (m, 1H), 3.9 (m, 1H), 3.4 (m, 1H), 2.85 (m, 1H), 2.7 (q, 2H), 2.49 (s, 6H), 1.26 (t, 3H).

EXAMPLE 9

Preparation of 4-(4.6-dimethyl-2-pyrimidinyl)2-(4-ethylphenyl)-5.6-dihydro-4H-1.3.4-thiadiazine
1.1-dioxide

4-(4,6-Dimethyl-2-pyrimidinyl)-2-(4-ethylphenyl)-5,6-dihydro-4H-1,3,4-thiadiazine 1-oxide (0.350 g,

1.06 mmol) was dissolved in 5 mL of methanol and 2.5 mL of water. The mixture was cooled to 0°C and Oxone® (potassium peroxymonosulfate) (0.490 g, 0.80 mmol) was added. The reaction was warmed to room temperature, stirred for 1 h, then heated at reflux for 10 min.

- stirred for 1 h, then heated at reflux for 10 min.

 After stirring at 25°C for 16 h, water was added and
 the reaction mixture was extracted twice with methylene
 chloride. The combined organic layers were washed with
 brine, dried over sodium sulfate, and concentrated.
- The crude product was passed through a plug of silica gel to yield 350 mg (96%) of a white solid, m.p. 139-141°C. ¹H NMR (CDCl₃) δ 7.90 (d, 2H), 7.27 (d, 2H), 6.72 (s, 1H), 5.05 (m, 2H), 3.55 (m, 2H), 2.67 (q, 2H), 2.47 (s, 6H), 1.24 (t, 3H).

15 EXAMPLE 10

Preparation of 4-(4,6-dimethyl-2-pyrimidinyl)-5,6-dihydro-2-phenoxy-4H-1,3,4-thiadiazine

O-Phenyl 2-(4,6-dimethyl-2-pyrimidinyl)hydrazinecarbothioate hydrochloride (4.00 g, 12.74 mmol) was

20 dissolved in 38.5 mL of 1N aqueous sodium hydroxide,
40 mL of THF, and 1.31 mL (15.29 mmol) of
1,2-dibromoethane. The reaction mixture was stirred at
25°C for 4 days. Methylene chloride was added and the
reaction was washed successively with water and brine.

25 After drying over sodium sulfate and concentrating, the
crude product was passed through a plug of silica gel
to give 2.48 g (8.27 mmol, 65%) of a solid, m.p.
75-85°C. ¹H NMR (CDCl₃) δ 7.31 (m, 4H), 7.18 (m, 1H),
6.47 (s, 1H), 4.39 (m, 2H), 3.29 (m, 2H), 2.36 (s, 6H).

The compounds illustrated below are referred to in the tables which follow. G^1 , G^2 , G^3 , X, Y, E and R^1-R^{28} are as defined for compounds of Formulae I-IV in the Summary of the Invention. In addition:

35 n = 0-2, as in the disclosure (e.g., Equation 2); $n^1 = 1-3$;

$$n^2 = 0-1;$$

 MCl_x = the metal chloride salts of copper, zinc, iron, magnesium, or manganese; and x = 1-2.

IJ

$$R^9$$
 X
 R^{10}
 G^2
 N
 N
 $C1$

IIc

$$\begin{array}{c|c}
CH_3 & CH_3 \\
R^7 & N & N \\
R^7 & R^6 & CH_3
\end{array}$$

$$\begin{array}{c|c}
CH_3 & CH_3$$

Ik

IId

Ile

The following abbreviations are used in the tables which follow. All alkyl groups are the normal isomers unless indicated otherwise.

t - is tertiary t-Bu - is tertiary-butyl s - is secondary c-Pr - is cyclopropyl n - is normal c-Hex - is cyclohexyl i - is iso s-Bu - is secondary-butyl c - is cyclo OMe - is methoxy Me - is methyl i-PrO - is isopropoxy Et - is ethyl SEt - is ethylthio Pr - is normal-propyl CN - is cyano Bu - is normal-butyl TBS - is t-butyldimethylsilyl Hex - is normal-hexyl Ac - is acetyl Ph - is phenyl S(O)Me - is methylsulfinyl Bzl - is benzyl S(O)₂Me - is methylsulfonyl i-Pr - is isopropyl

	Compounds of Formula Id	
$G^2=S$, $R^9=Me$, $Y=N$,	OCH2CH=CH2	i-Pr
X=CH	CH ₂ CH ₂ OMe	c-Pr
R ¹⁰	OCHF ₂	c-Hex
н	C≡CH	2-Me-c-Pr
C1	C≡CCH ₂ CH ₃	CF ₃
Br	OCH ₂ C≡CH	(CH ₂) 3CF3
F	NH ₂	SMe
CN	NMe ₂	SBu
OH	NHEt	S (0) Me
Me	4-morpholinyl	S (O) Bu
Hex	pyrrolidinyl	S (O) 2Me
Et	piperidinyl	S (O) 2Bu
í-Pr	Ph	OMe
c-Pr	PhO	OBu
c-Hex	4-Me-Ph	OCH ₂ CF ₃
2-Me-c-Pr	3-CF3-Ph	O(CH ₂) ₃ CF ₃
CF ₃	4-i-Pr-PhO	CH ₂ OMe
(CH ₂) ₃ CF ₃	4-F ₂ HCO-Ph	(CH ₂) ₃ OMe
SMe	3-Et-PhO	CH=CHMe
SBu	4-MeO-PhO	CH=CHCH2CH3
S (0) Me	4-MeO-Ph	CH=CHCH2CF3
S (0) Bu		CH=CCI ₂
S (0) 2 ^{Me}	G ² =O, R ⁹ =Me, Y=N,	OCH2CH=CH2
s (0) ₂ Bu	X=CR	CH ₂ CH ₂ OMe
Оме	R 10	OCHF ₂
OBu	H (10.75)	C=CH
OCH ₂ CF ₃	C1	C≡CCH ₂ CH ₃
O(CH ₂)3CF3	Br	OCH ₂ C≡CH
CH ₂ OMe	F	NH ₂
(CH ₂) ₃ OMe	CN	NMe ₂
СН=СНМе	OH	NHEt
CH=CHCH ₂ CH ₃	Me	4-morpholinyl
CH=CHCH2CF3	Hex	pyrrolidinyl
CH=CCl ₂	Et	piperidinyl

Ph	OBu	C1
PhO	OCH ₂ CF ₃	Br
4-Me-Ph	O(CH ₂) ₃ CF ₃	F
3-CF ₃ -Ph	CH ₂ OMe	CN
4-i-Pr-PhO	(CH ₂) ₃ OMe	он
4-F ₂ HCO-Ph	CH=CHMe	Me
3-Et-PhO	сн=снсн ₂ сн ₃	Hex
4-MeO-PhO	CH=CHCH ₂ CF ₃	Et
4-MeO-Ph	CH=CC1 ₂	i-Pr
	OCH2CH=CH2	c-Pr
$G^2=S$, Y=N, X=CH,	CH ₂ CH ₂ OMe	c-Hex
R10=H	OCHF ₂	2-Me-c-Pr
R ⁹	C≡CH	CF ₃
н	C=CCH ₂ CH ₃	(CH ₂) 3CF3
Cl	OCH ₂ C≡CH	SMe
Br	nh ₂	SBu
F ,	NMe ₂	S (0) Me
СИ	NHEt	S (O) Bu
ОН	4-morpholinyl	S (O) ₂ Me
Me	pyrrolidinyl	S (O) ₂ Bu
Hex	piperidinyl	OMe
Et	Ph	OBu
i-Pr	PhO	OCH ₂ CF ₃
c-Pr	4-Me-Ph	O(CH ₂)3CF3
c-Hex	3-CF ₃ -Ph	CH ₂ OMe
2-Me-c-Pr	4-i-Pr-PhO	(CH ₂) ₃ OMe
CF ₃	4-F ₂ HCO-Ph	Сн=Снме
(CH ₂) ₃ CF ₃	3-Et-PhO	сн=снсн ₂ сн
SMe	4-MeO-PhO	сн=снсн ₂ сг
SBu	4-MeO-Ph	CH=CCl ₂
S (0) Me		OCH2CH=CH2
S (O) Bu	$G^2=S$, $R^9=R^{10}=Me$,	CH ₂ CH ₂ OMe
S (0) 2Me	X=CR ¹³ , Y=N	OCHF ₂
S (O) 2Bu	R ¹³	C≡CH
OMe	Н	C≡CCH ₂ CH ₃
	· · · · · · · · · · · · · · · · · · ·	_ ~

OCH ₂ C≡CH	F	NMe ₂
NH ₂	СИ	NHEt
NMe ₂	ОН	4-morpholinyl
NHEt	Ме	pyrrolidinyl
4-morpholinyl	Hex	piperidinyl
pyrrolidinyl	Et	Ph
piperidinyl	i-Pr	PhO
Ph	c-Pr	4-Me-Ph
PhO	c-Hex	3-CF ₃ -Ph
4-Me-Ph	2-Me-c-Pr	4-i-Pr-PhO
3-CF ₃ -Ph	CF ₃	4-F ₂ HCO-Ph
4-i-Pr-PhO	(CH ₂) ₃ CF ₃	3-Et-PhO
4-F ₂ HCO-Ph	SMe	4-MeO-PhO
3-Et-PhO	SBu	4-MeO-Ph
4-MeO-PhO	S (0) Me	
4-MeO-Ph	S (O) Bu	G ² =0, R ⁹ =R ¹⁰ =Me
	S (O) ₂ Me	X=CR ¹³ , Y=N
G ² -S, R ⁹ -R ¹⁰ -Me,	S (O) ₂ Bu	R ¹³
X=CH, Y=CR ¹⁴	OMe	H
R ¹⁴	OBu	cı.
C1	OCH ₂ CF ₃	Br
Br	O(CH ₂) ₃ CF ₃	F
F	CH ₂ OMe	CN
Me	(CH ₂) ₃ OMe	ОН
Et	СН=СНМе	Me 💮
OMe	СН=СНСН ₂ СН ₃	Hex
OEt	CH=CHCH ₂ CF ₃	Et.
H	CH=CC1 ₂	f-Pr
	осн ₂ сн=сн ₂	c-Pr
G ² =0, Y=N, X=CH,	CH ₂ CH ₂ OMe	c-Hex
_R 10≟H	ochf ₂	2-Me- <i>c</i> -Pr
R ⁹	C≡CH	CF ₃
H	C≡CCH ₂ CH ₃	(CH ₂) 3CF3
C1	OCH ₂ C≡CH	SMe / C
Br	NH ₂	SBu
		· · · · · · · · · · · · · · · · · · ·

1	1	
S (0) Me		Ph
S (0) Bu	$G^2=0$, $R^9=R^{10}=Me$,	PhO
S (O) 2Me	X=CH, Y=CR ¹⁴	4-Me-Ph
S (O) 2Bu	R ¹⁴	4-MeO-Ph
OMe	C1	н
OBu	Br	
OCH ₂ CF ₃	F	G ² =S, R ⁹ =Me, Y=CH,
O(CH ₂) ₃ CF ₃	Me	X=N
CH ₂ OMe	Et	R ¹⁰
(CH ₂) ₃ OMe	OMe	Cl
СН=СНМе	OEt	Br
сн=снсн ₂ сн ₃	H	F
CH=CHCH ₂ CF ₃	•	CN
CH=CCl ₂	$G^2=S$, $R^9=Me$, $X=Y=N$	ОН
OCH2CH=CH2	R ¹⁰	Me
CH ₂ CH ₂ OMe	Cl	Et
ochf ₂	Br	i-Pr
C≡CH	F	c-Pr
с≡ссн₂сн₃	CN	CF ₃
och ₂ c≡ch	OH	SMe
NH ₂	Ме	S (0) Me
NMe ₂	Et	S (O) 2 ^{Me}
NHEt	i-Pr	OMe
4-morpholinyl	c-Pr	OEt
pyrrolidinyl	cr ₃	OCH ₂ OMe
piperidinyl	SMe .	OCH2CF3
Ph	S (O) Me	C=CHMe
PhO	S (O) 2Me	C=CMe
4-Me-Ph	OMe	NMe ₂
3-CF ₃ -Ph	OEt	Ph
4-i-Pr-PhO	OCH ₂ OMe	PhO
4-F ₂ HCO-Ph	OCH ₂ CF ₃	4-Me-Ph
3-Et-PhO	С=СНМе	4-MeO-Ph
4-MeO-PhO	C≡CMe	Н
4-MeO-Ph	NMe ₂	

G ² =O, R ⁹ =Me, X=Y=N	C=CHMe	
R ¹⁰		i-Pr
:	C≡CMe	c-Pr
C1	NMe ₂	CF ₃
Br ·	Ph	SMe
F	PhO	S (0) Me
CN	4-Me-Ph	S (O) ₂ Me
ОН	4-MeO-Ph	OMe
Me	H	OEt
Et		OCH ₂ OMe
i-Pr	G ² =O, R ⁹ =Me, Y=CH,	OCH ₂ CF ₃
c-Pr	X=N	С=СНМе
CF ₃	R ¹⁰	C ≕ CMe
SMe	CI	NMe ₂
S (O) Me	Br	Ph
S (O) 2 ^{Me}	F	PhO
OMe	СИ	4-Me-Ph
OEt	OH	4-MeO-Ph
OCH ₂ OMe	Me	H
OCH ₂ CF ₃	Et	w. V
G ² =S	<i>₹</i>	•
X X	R ¹⁴ R ⁹	R13 R10
N CR ¹⁴	-(CH ₂) ₃ -	Me
CH CR ¹⁴	-(CH ₂) ₃ -	Me
N CR ¹⁴	-(CH ₂) ₄ -	Me
CH CR ¹⁴	-(CH ₂) ₄ -	Me
CR ¹³	(CH ₂) ₃ -	Me
CR ¹³ CH	(CH ₂) ₃ -	Me
CR ¹³ N	(CH ₂) ₄ -	
CR ¹³ CH	(CH ₂) ₄ -	
CR ¹³ CH	Me	-(CH ₂) ₃ -
CR ¹³ . CH	Me	-(CH ₂) ₄ -
and the second of the second	Secretary (Sec.	TWINTER TANK

G ² =O				•	
X .	Y	R14	R ⁹	B ¹³	R10
N	CR ¹⁴	- (CH ₂)	3-		Me
СН	CR ¹⁴	- (CH ₂)	3-		Me
N	CR ¹⁴	- (CH ₂)	4-		Me
СН	CR ¹⁴	-(CH ₂)	4-		Me
CR ¹³	N		- (CH ₂)	э ⁻	Me
CR13	СН	·	-(CH ₂)	3-	Ме
CR ¹³	N		- (CH ₂)	4-	Me
CR ¹³	СН		- (CH ₂)	4-	Me
CR13	Сн		Me	- (CH ₂) ₃ –
CR ¹³	CH		Me	- (CH ₂	

TARLE 2

Compounds of Formula le

G ² =S,	X=Y=N,	$R^{\perp \perp} = R^{\perp \perp}$	=R ²⁸ =H			•	
R10			c-Pr			С=СНМе	
Cl			CF ₃			C≡CMe	
Br			SMe			NMe ₂	
F		,]	S (O)	Me	1	Ph	
CN			S (O)	2 ^{Me}		PhO	
ОН	<i>\$</i>		OMe			4-Me-	Ph
Me			OEt OCH ₂ OMe			4-MeO-Ph	
Et 🐰						H	,
i-Pr	*	:	OCH ₂	CF ₃		•	
, 2 (*)	r _e						
F 1.				•			
G ² =S	,			v _a			
X	X	R10	R ¹¹	R ¹²	R ²⁸	3	R31
CH	N -	Me	H	. Н	Н		H
n :	CH	Me	H	н	н		н
N	:N	Me	H	3-Me	4-M	le	H
N	N	Me	Н	3-Me	4-M	lė .	6−Me

N	N ·	Me	H	н .	4-i-Pr	é-OMe
N	N	Me	H	3-Me	H	7-CF3
N	N	Me	н	H	4-Et	7-Et
N	N	Me .	Ĥ	H	4- <i>i</i> -Pr	6-OCHF ₂
N	N	Me	H	H	H	8-Bu
N	N	Me	H	H	4-c-Pr	6-OEt
		•			•	

$G^2=0$, X=Y=N, $R^{11}=R^{12}$	_{=R} 28 _{≕H}	
R ¹⁰	c-Pr	С=СНМе
CI	CF ₃	C≡CMe
Br	SMe	NMe ₂
F	S (O) Me .	Ph
CN .	S (0) 2Me	PhO
OH -	OMe	4-Me-Ph
Ме	OEt	4-Me0-Ph
Et	OCH ₂ OMe	H.
1-Pr	OCH ₂ CF ₃	
		,
•	and the second s	

G ² =0			-	'		
X	X	R10	R ¹¹	R ¹²	R ²⁸	R ³¹
CH	N	Me	H	H	Ħ	н
N	CH	Me	H	H	H	H
N.	N	Me	H	3-ме	4-Me	н .
N	N	Me	н	3-Me	4-Me	6-Me
N	N	Me	Me	H	H	7-Me
N	N	Me	H	H	4-1-Pr	6-ОМе
N	N	Me	Ħ	3-Me	н	7-CF3
N	N	Me	н	H	4-Et	7-Et
N	N	Me	H.	. ' H	4-1-Pr	6-OCHF ₂
N	N	Me	н	н	H	8-Bu
N ·	N	Ме	н	Ħ	4-c-Pr	6-OEt

•	Compounds of Formula If	
$G^{2}=S$, $R^{12}=H$, $R^{28}=H$	$G^{2}=S$, $R^{1}1=R^{1}2=H$	4-C=CH
R ¹¹	R ²⁸	4-C=C-Et
н	4-Me	4-OCH ₂ C=CH
Me	4-CN	4-NMe ₂
Et.	4-NO ₂	4-C (=0) NMe ₂
i-Pr	4-он	4-Ph
<i>s</i> −Bu	4-со ₂ н	4-OPh
F	4-CO ₂ Et	4-SPh
CI	4-Et	4-(3-Me-Ph)
Br	4-i-Pr	•
CF ₃	4- <i>n</i> -Hex	G ² =S
. OMe	4-c-Pr	R^{11} R^{12} R^{28}
OEt	4-CF ₃	C1 H 6-C1
OCHF ₂	4-SMe	H 3-Me 4-Me
OBu	4-SBu	H 3-Me 4-Et
O(CH ₂) ₃ CF ₃	4-c-Hex	H 3-OMe 4-OMe
(CH ₂) ₃ CF ₃	4-C1	Me H 5-Me
G ² =S, R ¹¹ =H, R ²⁸ =H	4-Br	Me H 4-Me
R ¹²	4-F	Me 4-Me 5-Me
3-Me	4-(CH ₂) ₃ CF ₃	H 3-C1 5-C1
3-Et	4-S(0)Me	C1 H 4-C1
3- <i>i</i> -Pr	4-S (O) Bu	•
3- <i>s</i> -Bu	4-S (O) 2Me	$G^{2}=0$, $R^{12}=H$, $R^{28}=H$
3-F	4-S (O) 2Bu	R ¹¹
3-C1	4-OMe	H
3-Br	4-OBu	Me
3-CF ₃	4-OCH ₂ CF ₃	Et
3-OMe	4-OCH ₂ OMe	i-Pr
3-0Et	4-CH ₂ OMe	s−Bu
3-0CHF ₂	4-СН=СН-Ме	F
3-OBu	4-CH=CHCH ₂ Me	C1
3-0 (CH ₂) ₃ CF ₃	4-TBS	Br
3-(CH ₂) ₃ CF ₃	4-SiMe ₃	CF ₃

r	4.			
OMe .·	4-c-Pr	н	3-Me	4-Me
OEt	4-CF3	H	3-Me	4-Et
OCHF ₂	4-SMe	H	3-0Me	4-OMe
OBu	4-SBu	Me	H	5-Me
O(CH ₂) ₃ CF ₃	4-c-Hex	Me	H	4-Me
(CH ₂) ₃ CF ₃	4-C1	Me	4-Me	5-Me
ert i	4-Br	H	3-C1	5-C1
G ² =O, R ¹¹ =H, R ²⁸ =H	4-F	CI	H	4-Cl
R ¹²	4-(CH ₂) ₃ CF ₃		٠.	
3-Me	4-S (0) Me	G ² =S	(O), R ¹²	=H,
3-Et	4-S (O) Bu	R ²⁸ =1	H .	
3-1-Pr	4-S (O) 2Me	R ¹¹		
3- <i>s</i> -Bu	4-S (O) 2Bu	H	٠.	
3-F	4-0Me	Me	•	
3-C1	4-QBu	Et		
3-Br	4-OCH ₂ CF ₃	i−Pr		
3-CF ₃	4-0CH ₂ OMe	<i>s</i> −Bu		
3-0Me	4-CH ₂ OMe	F		
3-0Et	4−CH=CH -M e	Cl		
3-0CHF ₂	4-CH-CHCH ₂ Me	Br		•
3-0Bu	4-TBS	CF ₃		
3-0 (CH ₂) ₃ CF ₃	4-SiMe ₃	ОМе		
3-(CH ₂) ₃ CF ₃	4-C≖CH	OEt	•	
	4-C≡C-Et	OCHF	2 .	•
$G^{2}=0$, $R^{11}=R^{12}=H$	4-0CH ₂ C=CH	OBu	. : ,: : : :	
R ²⁸	4-NMe ₂	O (CH	2) 3 ^{CF} 3	
4-Me	4-C (=0) NMe ₂	(CH ₂) 3 ^{CF} 3	. ,
4-CN	4-Ph			
4-NO ₂	4-0Ph	G ² =S	(O), R ¹	L _{=H} ,
4-OH	4-SPh	_R 28 ₌		
4-CO ₂ H	4-(3-Me-Ph)	R ¹²	11 14 14 14 14 14 14 14 14 14 14 14 14 1	
4-CO ₂ Et	A mercycle	3-Me		.
4-Et	g ² ≑o	3-Et		
4- <i>i</i> -Pr	R ¹¹ R ¹² R ²⁸	3-1-	Pr	
4- <i>n</i> -Hex	CI H 6-CI	3- <i>s</i> -	Bu	
	•			

3-F	4-01	1 e		Me
3-C1	4-OBu			Et
3-Br	4-00	CH ₂ CF ₃		i-Pr
3-CF ₃	4-00	CH ₂ OMe	•	s−Bu
3-OMe	4-CF	i ₂ 0Me		F
3-0Et	4-CI	I=CH-Me		Cl
3-0CHF ₂	4-Ci	I=CHCH ₂ M	е	Br
3-OBu	4-TE	ss		CF ₃
3-0 (CH ₂) 3CF3	4-Si	.Me ₃		OMe
3-(CH ₂) ₃ CF ₃	4-C=	ECH .		OEt
	4-C≡	C-Et		OCHF ₂
$G^2=S(0), R^{11}=R^{12}=H$	4-00	н2с≡сн	•	OBu
R ²⁸	4-NM	le ₂		O(CH ₂) ₃ CF ₃
4-Me .	4-C (=0) NMe ₂	•	(CH ₂) ₃ CF ₃
4-CN	4-Ph	ı		
4-NO ₂	4-OP	h		G ² =S(O) ₂ , R ¹¹ =H,
4-OH	4-SP	h .		R ²⁸ =H
4-CO ₂ H	4-(3	-Me-Ph)		R ¹²
4-co ₂ Et	· ·			3-Me
4-Et	G ² =S			3-Et
4-i-Pr	R ¹¹	R12	R ²⁸	3- <i>i-</i> Pr
4- <i>n</i> -Hex	Cl	H	6-C1	3- <i>s</i> -Bu
4- <i>c</i> -Pr	H	3-Me	4-Me	3 - F
4-CF ₃	H	3- M e	4-Et	3-C1
4-SMe	H	3-0Me	4-OMe	3-Br
4-SBu	Me	H	5 - Me	3-CF ₃
4-c-Hex	Me	H	4-Me	3-0Me
4-C1	Me	4-Me	5-Me	3-0Et
4-Br	H	3-C1	5-C1	3-0CHF ₂
4-F	Cl	H	4-C1	3-OBu
4-(CH ₂) ₃ CF ₃				3-0 (CH ₂) ₃ CF ₃
4-S (O) Me		$(0)_2, R^1$	2 _{=H} ,	3-(CH ₂) ₃ CF ₃
4-S (O) Bu	R ²⁸ =	Н		
4-S (O) ₂ Me	R ¹¹			
4-S (O) 2Bu	н			

 $G^2=S(0)_2$, $R^{11}=R^{12}=H$ R²⁸ 4-Me 4-CN 4-NO2 4-OH 4-CO2H 4-CO₂Et 4-Et 4-*i*-Pr 4-n-Hex 4-c-Pr 4-CF3 4-SMe 4-SBu 4-c-Hex 4-C1 4-Br 4-F 4-(CH₂)₃CF₃ 4-S (O) Me 4-S (O) Bu 4-S (O) 2Me 4-S (O) 2Bu 4-OMe 4-0Bu 4-0CH2CF3 4-0CH₂OMe 4-CH₂OMe

1. A.

4-СН-СН-Ме 4-CH=CHCH₂Me 4-TBS 4-SiMe₃ 4-C=CH 4-C=C-Et 4-OCH2C≡CH 4-NMe₂ 4-C (=0) NMe2 4-Ph 4-OPh 4-SPh 4-(3-Me-Ph) G²=S (O) 2 R^{11} R12 R²⁸ Cl 6-C1 H 3-Me 4-Me Ħ 3-Me 4-Et 3-OMe 4-OMe 5-Me Me -H 4-Me Me Me 4-Me 5-Me H 3-C1 5-C1 CI H · 4-C1

Compounds	οf	Formula	Ig
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Compounds	i Formura 19
n ¹ =1	Et
R ²⁷	Bu
н	i-Pr
Et	CHF ₂
Bu	(CH ₂) ₃ CF ₃
i-Pr	CO ₂ Et
CHF ₂	C (=O) Me
(CH ₂) ₃ CF ₃	C (=0) (CH ₂) 3Me
CO ₂ Et	C (=0) Ph
C (=0) Me	(3-Me-Ph)C(=0)
C(=0)(CH ₂) ₃ Me	(4-OMe-Ph)C(=O)
C (=0) Ph	CH ₂ C≕CH ₂
(3-Me-Ph) C (=0)	сн ₂ с = сн
(4-OMe-Ph) C (=O)	PhCH ₂
CH ₂ C=CH ₂	4-Me-PhCH ₂
CH ₂ C≡CH	S (0) ₂ Me
PhCH ₂	C (=0) NMe ₂
4-Me-PhCH ₂	C (=S) NHMe
S (=0) ₂ Me	5 (0) Me
C (=0) NMe ₂	S (0) 2Ph
C (=S) NHMe	(4-Me-Ph) S (0) 2
S (O) Me	C (=0) NHPh
S (O) ₂ Ph	C (=S) NHPh
(4-Me-Ph) S (0) 2	P (=S) (OEt) 2
C (=0) NHPh	P (=0) (OEt) 2
C (=S) NHPh	S (0) 2N (Et) 2
P (=S) (OEt) ₂	•
P (=0) (OEt) ₂	n ¹ =3
S (O) ₂ N (Et) ₂	R ²⁷
n ¹ =2	H :
	Et
R ²⁷	Bu
н	i-Pr

H

•				
CHF ₂	1	1	S	(0)
(CH ₂) 3CF3	1	2	S	(0)
CO ₂ Et	2	1	S	(O)
C (=0) Me	0	3	S	(0)
C (=O) (CH ₂) 3Me	1	1	S	(O) ₂
C (=0) Ph	1	2	S	(O) ₂
(3-Me-Ph)C(=0)	2	1	S	(O) ₂
(4-OMe-Ph)C(=0)	0	3	S	(O) ₂
Сн ₂ с=сн ₂	1	1	N-	-ме
CH ₂ C≡CH	1	2	N-	-Me
PhCH ₂	2	1	N-	-ме
4-Me-PhCH ₂		•		
S (O) 2 ^{Me}		TAB	LE 6	
C (=0) NMe ₂	1	Compounds of	Formul	a Ii
C (=S) NHMe	G ² =S		• ! .	
S (O) Me	n ²	R ¹	R7 R	1 R8
S (O) 2Ph	1	Me	н н	H
(4-Me-Ph) S (O) 2	1	Bu	н н	H
C (=0) NHPh	1	Ме	Ме Н	H
C (=S) NHPh	1	Ħ	H Me	e H
P (=S) (OEt) 2	1	H	H B	и н
P (=0) (OEt) 2	1	Ph	H H	H
S (O) 2N (Et) 2	1	4-Me-Ph	н н	H
(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	1	4-OMe-Ph	H H	H
TABLE 5	Ó	Me	н	
Compounds of Formula Ih	0	Bu det de la company	н -	
\mathbf{n} \mathbf{n}^{1}	.0	Me		-, '
1 1 S	0	Ph Profes	н -	
1 2 S	0	4-Me-Ph	н -	
2 1 S	1		45 1	
o 3 S	G ² =€			٠
1 0	n ²	\mathbb{R}^{1}	R ⁷ R	4 <u>R</u> 8
1 2 0	1	Me	н н	H

1	Н .	H	Me	H		1	4-Me-Ph	H	Н
1	Н	н	Bu	H		1	H	Ph	Н
1	Ph	H	H	н		1	H	4-Me-Ph	Н
.1	4-Me-Ph	. Н	H	H		1	H	Н	Ph
1,	4-OMe-P	h H	H	н		1	H	H	4-Me-Ph
0	Me	H							
0	Bu	, H				G ² -	= 0	*	. ,
0	Me	Ме				n ²	R ¹	R ²	R ³
0	Ph	H				0	Me	H ·	
0	4-Me-Ph	. н			•	0	Bu.	H	
	•					0	H	Me	
	!	TABLE 7	_			0	н	Bu	
	Compounds	of For	mula :	Γj		5.0	Ph	H	
G ² -	_					0.	4-Me-Ph	H	
n ²	R ¹	R ²		3		0	H	4-OMe-Ph	·
0	Me	H		-		1	Me	H.	H
0	Bu	H .				1	Bu .	H	H
. 0	H	Me	-	-		n ²	R ¹	R ²	R ³
0	H	Bu	•			1	H • •	Me	H
0	Ph	H,	-	-		1	·H	. Bu	H
0	4-Me-Ph	H	* 1.			1	H	H	Me
0	H	4-0Me-	-Ph -	:		.1	H	н	Bu
1	Me	3 H -12		ı		1	Ph	н	н
1	Bu	H	Ŧ	I		n^2	R ¹	R ²	R ³
1	H	Me	I	I .	.	1	4-Me-Ph	H	H
1	H	Bu	E			1	H .	Ph	Н
1	H	H	P	le		· 1	н	4-Me-Ph	H
1	H	H ,	, 1 e	u	į	1	H	H	Ph
1	Ph	.H	H	i ·		1 .	H	H	4-Me-Ph

CABLE 8

•	1. 24 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Compounds	or Lormans	IK	
G ² =S			H	H Ph	н
R ¹	R ⁷ R ⁵	B 6	н	H H	Me
H	н ме	H	н	н н	Ph

H

Bu

H

H

4-Me-Ph

Ή,

Bu 4-OMe-Ph

> H H

			1		
Me	H	H	н	Ph	H
Me	Me	H	н	H	Ph
Ph	H	H	н	H .	H
H	Ph	H	н	H	H
H	H .	Bu	н	H	H
н	н	4-Me-Ph	н	н	H
н	H	н	Bu	Bu	H
Ħ	H	H	4-OMe-Ph	3-Me-Ph	H
Bu	н	н	H	4-OMe-Ph	H
3-Me-Ph	н	_ H	н	•	
4-OMe-Ph	H	H	н	•	•
G ² =0					
R ¹	r.7	R ⁵	R ⁶		
H	H	Me	H ·	•	
H	H	Ph	Ħ		
H	H	H	Me		
H	H	Ħ	Ph		
Me	· H	H.	H	•	
Me	Me	H :	H		
				:	

TABLE 9

Compounds of Formula 11

Compounds of	roimara
G ² =S	3-thienyl
E	2,5-diMe-3-furanyl
H .	2,5-diMe-3-thienyl
Me	4-Me-PhO
n-flex	2-C1-PhO
c-Hex	2,6-diMe-PhO
PhCH ₂	4-Me-PhNH
CH ₂ CH ₂ CF ₃	3-Me-PhS
ОВи	s-BuS
O(CH ₂) ₅ C1	1-indanyl
1-naphthalenyl	5-Me-2-thienyl
2-naphthalenyl	5-Me-2-pyridyl
2-furanyl	4-Me-3-furanyl
	*

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2-Me-3-pyridyl
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G²=0

E

H

Me

n-Hex

c-Hex

PhCH₂

CH2CH2CF3

OBu

O(CH2)5C1

1-naphthalenyl

2-naphthalenyl

2-furanyl

3-thienyl

2,5-diMe-3-furanyl

2,5-diMe-3-thienyl

4-Me-PhO

2-C1-PhO

2,6-diMe-PhO

4-Me-PhNH

3-Me-PhS

s-BuS

1-indanyl

5-Me-2-thienyl

5-Me-2-pyridyl

4-Me-3-furanyl

2-Me-3-pyridyl

G²=S (O)

E

H

Me

n-Hex

c-Hex

PhCH₂

CH2CH2CF3

OBu

O(CH2)5C1

1-naphthalenyl

2-naphthalenyl

2-furanyl

3-thienyl

2,5-diMe-3-furanyl

2,5-diMe-3-thienyl

4-Me-PhO

2-C1-PhO

2,6-diMe-PhO

4-Me-PhNH

3-Me-PhS

s-BuS

1-indanyl

5-Me-2-thienyl

5-Me-2-pyridyl

4-Me-3-furanyl

2-Me-3-pyridyl

 $G^2=S(0)_2$

E

H

Me

n-Hex

c-Hex

PhCH2

CH2CH2CF3

OBu

O(CH2)5C1

1-naphthalenyl

2-naphthalenyl

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2-furanyl	3-Me-PhS
3-thienyl	s-BuS
2,5-diMe-3-furanyl	1-indanyl
2,5-diMe-3-thienyl	5-Me-2-thienyl
4-Me-PhO	5-Me-2-pyridyl
2-C1-PhO	4-Me-3-furanyl
2,6-diMe-PhO	2-Me-3-pyridyl
4-Me-PhNH	

TABLE 10

		Compounds of	formula	IIIc	
⊊ 2	n	n ¹	s (O)	1	1
s ·	O	1	S (O)	1	2
s ·	σ.	2 .	S (O)	2	1
s	Ō	3	s (0) ₂	·O-	1
s	1	1	S(0)2	0	2
S	1	2	S(0)2	0	3
s	, 2	1	s(0) ₂	· 1	1
0	.0	1	s(0)2	1	2
0	.0	2	s(0) ₂	2	1
0	O	3	NMe	0	1
0	ī	1	NMe	0	2
0	1	2	NMe	0	3
0	2	·1 ··· ·	NMe	1	1
S (O)	0	1	NMe	1	2
S (O)	0	2	NMe	2	1
s (o)	O	3	ł	5 E	495.

	ું કે જ	Compounds of Form	nula IIc
G ² =S,	R ⁹ =Me, Y=N,	Br	Hex
х=сн		E	Et
R ¹⁰		CN	i-Pr
H		ОН	c-Pr
CI		Me	c-Hex

•		
2-Me- <i>c</i> -Pr	4-i-Pr-PhO	(CH ₂) ₃ OMe
CF ₃	4-F ₂ HCO-Ph	СН=СНМе
(CH ₂) ₃ CF ₃	3-Et-PhO	сн=снсн ₂ сн ₃
SMe	4-MeO-PhO	CH=CHCH ₂ CF ₃
SBu	4-MeO-Ph	CH=CCl ₂
S (O) Me		OCH ₂ CH=CH ₂
S (O) Bu	G ² =O, R ⁹ =Me, Y=N,	CH ₂ CH ₂ OMe
S (0) ₂ Me	Х=СН	OCHF ₂
S (O) 2Bu	R ¹⁰	C≡CH
OMe	H	C≡CCH ₂ CH ₃
OBu	Cl	OCH ₂ C≡CH
OCH ₂ CF ₃	Br	NH ₂
O(CH ₂) ₃ CF ₃	F	NMe ₂
CH ₂ OMe	CN	NHEt
(CH ₂) 30Me	ОН	4-morpholinyl
Сн=Снме	Me	pyrrolidinyl
сн=снсн ₂ сн ₃	Hex	piperidinyl
CH=CHCH ₂ CF ₃	Et	Ph
CH=CCl ₂	i-Pr	PhO
OCH ₂ CH=CH ₂	c-Pr	4-Me-Ph
CH ₂ CH ₂ OMe	c-Hex	3-CF ₃ -Ph
OCHF ₂	2-Me-c-Pr	4-1-Pr-PhO
C=CH	CF ₃	4-F ₂ HCO-Ph
C≡CCH ₂ CH ₃	(CH ₂) ₃ CF ₃	3-Et-PhO
OCH ₂ C≡CH	SMe	4-MeO-PhO
NH ₂	SBu	4-MeO-Ph
NMe ₂	S (0) Me	
NHEt	S (O) Bu	$G^2=S$, Y=N, X=CH,
4-morpholinyl	S (O) ₂ Me	R ¹⁰ ≕H
pyrrolidinyl	S (O) 2Bu	_R 9
piperidinyl	OMe	н
Ph .	OBu	C1
PhO	OCH ₂ CF ₃	Br
4-Me-Ph	O(CH ₂) ₃ CF ₃	F
3-CF ₃ -Ph	CH ₂ OMe	CN
	•	

S (O) 2Me

· · · · · · · · · · · · · · · · · · ·	
OH	4-morpholinyl
Me	pyrrolidinyl
Hex	piperidinyl
Et	Ph
i-Pr	PhO
c-Pr	4-Me-Ph
c-Rex	3-CF ₃ -Ph
2-Me- <i>c</i> -Pr	4-i-Pr-PhO
CF3	4-F ₂ HCO-Ph
(CH ₂) ₃ CF ₃	3-Et-PhO
SMe	4-MeO-PhO
SBu	4-MeO-Ph
S (0) Me	
S (0) Bu	$G^2=S$, $R^9=R^{10}=Me$,
S (0) 2Me	X=CR ¹³ , Y=N
S (0) 2Bu	R ¹³
OMe	Ħ
OBu	CI
OCH ₂ CF ₃	Br
O(CH ₂) ₃ CF ₃	F
CH ₂ OMe	CN
(CH ₂) ₃ OMe	ОН
СН=СНМе	Me
СH=СНСН ₂ СН ₃	Hex
CH=CHCH ₂ CF ₃	Et
CH=CC1 ₂	i-Pr
OCH2CH=CH2	c-Pr
CH ₂ CH ₂ OMe	c-Hex
OCHF ₂	2-Me-c-Pr
C=CH	CF ₃
C≡CCH ₂ CH ₃	(CH ₂) ₃ CF ₃
осн2с≡сн	SMe
NH ₂	SBu
NMe ₂	S (O) Me
NHEt	S (O) Bu
•	•

S (O) 2Bu OMe OBu OCH₂CF₃ O(CH₂)3CF3 CH₂OMe (CH₂) 30Me CH=CHMe CH=CHCH2CH3 CH=CHCH2CF3 CH=CCl₂ OCH2CH-CH2 ${\rm CH_2CH_2OMe}$ OCHF₂ С≕СН C≖CCH₂CH₃ OCH2C=CH NH₂ NMe_2 NHEt 4-morpholinyl pyrrolidinyl piperidinyl Ph PhO 4-Me-Ph 3-CF3-Ph 4-1-Pr-PhO 4-F2HCO-Ph 3-Et-PhO 4-MeO-PhO 4-MeO-Ph

$G^2=S$, $R^9=R^{10}=Me$,	S (O) ₂ Bu	R ¹³
X=CH, Y=CR ¹⁴	OMe	н
R ¹⁴	OBu	C1
Cl	OCH ₂ CF ₃	Br
Br	O(CH ₂) ₃ CF ₃	F
F	CH ₂ OMe	CN
Me	(CH ₂) ₃ OMe	ОН
Et	Сн-Снме	Me
OMe .	CH=CHCH ₂ CH ₃	Hex
OEt et.	CH=CHCH2CF3	Et
н ,	CH=CC1 ₂	i-Pr
	OCH2CH-CH2	c-Pr
G ² =0, Y=N, X=CH,	CH ₂ CH ₂ OMe	с-нех
R ¹⁰ =H	ochf ₂	2-Me-c-Pr
R ⁹	C≡CH	CF ₃
H	C=CCH ₂ CH ₃	(CH ₂) ₃ CF ₃
C1	OCH ₂ C≅CH	SMe
Br	NH ₂	SBu
F	NMe ₂	S (0) Me
CN ;;;	NHEt	S (O) Bu
ОН	4-morpholinyl	S (O) 2Me
Me	pyrrolidinyl	S (O) ₂ Bu
Hex	piperidinyl	OMe
Et	Ph	OBu
i-Pr	PhO	OCH ₂ CF ₃
c-Pr	4-Me-Ph	O(CH ₂)3CF3
c-Hex	3-CF ₃ -Ph	СН ₂ ОМе
2-Me- <i>c</i> -Pr	4-i-Pr-PhO	(CH ₂) ₃ OMe
CF ₃	4-F ₂ HCO-Ph	СН=СНМе
(CH ₂) ₃ CF ₃	3-Et-PhO	сн=снсн ₂ сн ₃
SMe	4-MeO-PhO	сн=снсн ₂ сг ₃
SBu	4-MeO-Ph	CH=CC1 ₂
S (O) Me		осн ₂ сн=сн ₂
S (O) Bu	$G^{2}=0$, $R^{9}=R^{10}=Me$,	сн ₂ сн ₂ оме
S (0) 2Me	X=CR ¹³ , Y=N	OCHF ₂
	•	

C=CH	F	c-Pr
C≡CCH ₂ CH ₃	CN	CF ₃
осн ₂ с≖сн	ОН	SMe
NH ₂	Me	S (0) Me
NMe ₂	Et	S(0) 2Me
NHEt	i-Pr	OMe
4-morpholinyl	c-Pr	OEt
pyrrolidinyl	CF ₃	OCH ₂ OMe
piperidinyl	SMe	OCH ₂ CF ₃
Ph	S (0) Me	С=СНМе
PhO	S (O) 2 ^{Me}	C=CMe
4-Me-Ph	OMe	NMe ₂
3-CF ₃ -Ph	OEt	Ph
4-i-Pr-PhO	OCH ₂ OMe	PhO
4-F ₂ HCO-Ph	OCH ₂ CF ₃	4-Me-Ph
3-Et-PhO	С=СНМе	4-MeO-Ph
4-MeO-PhO	C=CMe	H
4-MeO-Ph	NMe ₂	
	Ph	$G^2=0$, $R^9=Me$, $X=Y=N$
$G^2=0$, $R^9=R^{10}=Me$,	PhO	R ¹⁰
X=CH, Y=CR ¹⁴		C1
0.07	4-Me-Ph	CI.
R ¹⁴	4-Me-Ph 4-MeO-Ph	Br
R ¹⁴	4-MeO-Ph	Br
R ¹⁴	4-MeO-Ph	Br F
R ¹⁴ CI Br	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N	Br F CN
R ¹⁴ CI Br F	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH,	Br F CN OH
R ¹⁴ CI Br F	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N	Br F CN OH Me
R ¹⁴ CI Br F Me	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ¹⁰	Br F CN OH Me Et
R ¹⁴ CI Br F Me Et OMe	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ¹⁰ C1	Br F CN OH Me Et 1-Pr
R ¹⁴ CI Br F Me Et OMe	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ^{1.0} CI Br	Br F CN OH Me Et 1-Pr c-Pr
R ¹⁴ C1 Br F Me Et OMe OEt H	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ¹⁰ CI Br F	Br F CN OH Me Et 1-Pr C-Pr CF3
R ¹⁴ C1 Br F Me Et OMe OEt H G ² =S, R ⁹ =Me, X=Y=N R ¹⁰	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ^{1.0} CI Br F	Br F CN OH Me Et 1-Pr C-Pr CF3 SMe
R ¹⁴ C1 Br F Me Et OMe OEt H G ² =S, R ⁹ =Me, X=Y=N R ¹⁰	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ¹⁰ CI Br F CN OH	Br F CN OH Me Et i-Pr C-Pr CF3 SMe S(O)Me
R ¹⁴ C1 Br F Me Et OMe OEt H	4-MeO-Ph H G ² =S, R ⁹ =Me, Y=CH, X=N R ^{1.0} CI Br F CN OH	F CN OH Me Et 1-Pr C-Pr CF3 SMe S(0) Me S(0) 2Me

•		•	
OCH ₂ OMe	C1 .	OEt	
OCH ₂ CF ₃	Br	OCH ₂ OMe	
C=CHMe	F	OCH ₂ CF ₃	
C=CMe	CN	С=СНМе	
NMe ₂	ОН	C≕CMe	,
Ph	Me	NMe ₂	
PhO	Et	Ph	
4-Me-Ph	1-Pr	PhO	•
4-MeO-Ph	c-Pr	4-Me-Ph	
H	CF ₃	4-Me0-P1	a.
	SMe	н	
G ² =O, R ⁹ =Me, Y=CH,	S (0) Me	1	
X=N	S (0) ₂ Me		
R ¹⁰	OMe		
•		•	•
G ² =S	:		
X Y	R^{14} R^{2}	R ¹³	R ¹⁰
N CR ¹⁴	-(CH ₂) ₃ -	. 	Me
CH CR ¹⁴	- (CH ₂) 3-		Me
N CR ¹⁴	- (CH ₂) ₄ -		Me
CH CR ¹⁴	-(CH ₂) ₄ -	——	Me
CR ¹³ N		-(CH ₂) ₃ -	Me
СR ¹³ СН		-(CH ₂) ₃ -	Me
CR ¹³ N		-(CH ₂) ₄ -	Me
CR ¹³ CH		-(CH ₂) ₄ -	Me
CR ¹³ CH	Me	• •	o) a-
CR ¹³ CH	Me		
		· · · · · · · · · · · · · · · · · · ·	
G ² =0			
x x	R ¹⁴ R ⁹	_{:R} 13	R ¹⁰
N CR ¹⁴	-(CH ₂) ₃ -		Me
CH CR ¹⁴	- (CH ₂) ₃ -	· .	Me
N CR ¹⁴	-(CH ₂) ₄ -		Me
CH CR ¹⁴	-(CH ₂) ₄ -		Me
CR ¹³ N		-(CH ₂) ₃ -	Me
	•	4.3	

CR ¹³	СН	·	-(CH ₂) ₃ -	Me
CR ¹³	N.		-(CH ₂) ₄ -	Me
CR13	CH	. 	-(CH ₂) ₄ -	Me
CR13	CH		Me	-(CH ₂) ₃ -
CR ¹³	СН	· 	Me	-(CH ₂) ₄ -

Compounds of Formula IId

$G^2=S$, $X=Y=N$, R^{11}	=R ¹² =R ²⁸ =H	
R ¹⁰	c-Pr	С=СНМе
CI.	CF ₃	C≖CMe
Br	SMe	NMe ₂
F	S (O) Me	Ph
CN	S (O) 2Me	PhO
OH	OMe	4-Me-Ph
Me	OEt	4-MeO-Ph
Et	OCH ₂ OMe	H
1-Pr	OCH ₂ CF ₃	
	在进行	

$G^2=S$, R	ru=Me		50 × 10 m	*	
X	. x :	R ¹¹	R ¹²	R ²⁸	R ³¹
CH	N .	H	H	H	H
N	CH	H	H	H	H
N	N	H	3-Me	4-Me	H
. n	N	H 974	3-Me	4-Me	6-Me
: N (- 3) ()	N	Me	H	H	7-Me
N	N	Ħ	H	4-1-Pr	6-OMe
N	N	H	3-Me	H	7-CF3
N	N	Ħ	H	4-Et	7-Et
N	N	H.	H // ·	4-1-Pr	6-OCHF
N	N	н .	H	H	8-Bu
N	N	R	H Carry	4-c-Pr	6-OEt

$G^2=0$, $X=Y=N$, $R^{11}=R^{12}$	2 _{=R} 28 _{=H}		
R ¹⁰	c-Pr	OCH ₂ CF ₃	
Cl	CF ₃	C=CHMe	
Br	SMe	C=CMe	•
F	S (O) Me	NMe ₂	
CN	S (O) 2 ^{Me}	Ph	
OH	OMe	PhO	
Me	OEt	4-Me-Ph	
Et	OCH ₂ OMe	4-MeO-Ph	
i-Pr	· ·	н	
G ² =0, R ¹⁰ =Me			
X X	R ¹¹ R ¹²	R ²⁸	R ³¹
CH N F	н	Н	H
N CH F	н н	H	H
n n i	i 3-Me	4-Me	H
n n f	I 3-Ме	4-Me	6-Me
n n	le H	H	7-Me
N N E	н н	4-i-Pr	6-OMe
N N F	3-Me	H	7-CF ₃
N N	н	4-Et	7-Et
N N F	H H	4-1-Pr	6-OCHF ₂
N N F	H H	н	8-Bu
N N	н	4-c-Pr	6-OEt

	Compounds of Formula	IIe
$G^2=S$, $R^{12}=H$, $R^{28}=H$	Br	$G^2=S$, $R^{11}=H$, $R^{28}=H$
R ¹¹	CF ₃	R ¹²
н	OMe	3-ме
Me	OEt	3-Et
Et'	ochf ₂	3- <i>i-</i> Pr
i-Pr	OBu	3- <i>s</i> -Bu
<u>s</u> -Bu	O(CH ₂) ₃ CF ₃	3-F
F	(CH ₂) ₃ CF ₃	3-C1
C1		3-Br

	1	
3-CF ₃	4-OCH ₂ OMe	F
3-ОМе	4-CH ₂ OMe	G1
3-0Et	4-СН=СН-Ме	Br
3-0CHF ₂	4-CH=CHCH ₂ Me	CF ₃
3-0Bu	4-TBS	OMe
3-0 (CH ₂) ₃ CF ₃	4-SiMe3	OEt
3-(CH ₂) ₃ CF ₃	4-C≡CH	OCHF ₂
! *	4-C≡C-Et	OBu
$G^2=S$, $R^{11}=R^{12}=H$	4-och ₂ c≡ch	O(CH ₂) ₃ CF ₃
R ²⁸	4-NMe ₂	(CH ₂) ₃ CF ₃
4-Me	4-C (=0) NMe ₂	
4-CN	4-Ph	$G^2=0$, $R^{11}=H$, $R^{28}=H$
4-NO ₂	4-OPh	R ¹²
4-OH	4-SPh	3-Me
4-со2н	4-(3-Me-Ph)	3-Et
4-CO ₂ Et		3- <i>1</i> -Pr
4-Et	G ² =S	3- <i>s</i> -Bu
4-i-Pr	R ¹¹ R ¹² R ²⁸	3-F
4-n-Hex	C1 H 6-C1	3-C1
4-c-Pr	н 3-ме 4-ме	3-Br
4-CF ₃	H 3-Me 4-Et	3-CF3
4-SMe	н 3-оме 4-оме	3-0Me
4-SBu	Me H 5-Me	3-0Et
4- <i>c</i> -Hex	Me H 4-Me	3-OCHF ₂
4-C1	Me 4-Me 5-Me	3-0Bu
4-Br	H 3-C1 5-C1	3-0 (CH ₂) 3CF ₃
4-F	C1 H 4-C1	3-(CH ₂) ₃ CF ₃
4-(CH ₂) ₃ CF ₃		4-Me
4-S (0) Me	G ² =0, R ¹² =H, R ²⁸ =H	
4-S (O) Bu	R ¹¹	$G^2=0$, $R^{11}=R^{12}=H$
4-S (O) 2Me	н	R ²⁸
4-S (O) 2Bu	Me	4-CN
4-0Me	Et	4-NO ₂
4-0Bu	i−Pr	4-OH
4-OCH ₂ CF ₃	s−Bu	4-со ₂ н
	•	•

4 00 54		1 -211
4-CO ₂ Et		$G^2=S(0), R^{11}=H,$
4-Et	G ² =0	R ²⁸ =H
4-1-Pr	R ¹¹ R ¹² R ²⁸	R ¹²
4- <i>n</i> -Hex	C1 H 6-C1	3-Me
4-c-Pr	H 3-Me 4-Me	3-Et
4-CF ₃	H 3-Me 4-Et	3-i-Pr
4-SMe	H 3-OMe 4-OMe	3- <i>s</i> -Bu
4-SBu	Me H 5-Me	3-F
4- <i>c</i> -Hex	Me H 4-Me	3-C1
4-C1	Me 4-Me 5-Me	3-Br
4-Br	H 3-C1 5-C1	3-CF ₃
4-F	C1 H 4-C1	3-OMe
4-(CH ₂) ₃ CF ₃		3-0Et
4-S (O) Me	$G^2=S(0)$, $R^{12}=H$,	3-0CHF ₂
4-S (O) Bu	R ²⁸ =H	3-0Bu
4-S (O) ₂ Me	R ¹¹	3-0 (CH ₂) 3CF ₃
4-S (O) 2Bu	H	3-(CH ₂) ₃ CF ₃
4-0Me	Me	
4-0Bu	Et	$G^2=S(0), R^{11}=R^{12}=H$
4-OCH ₂ CF ₃	i-Pr	R ²⁸
4-OCH ₂ OMe	s-Bu	4-Me
4-CH ₂ OMe	F	4-CN
4-CH=CH-Me	Cl	4-NO ₂
4-CH=CHCH ₂ Me	Br	4-OH
4-TBS	CF ₃	4-co ₂ H
4-SiMe ₃	OMe	4-co ₂ Et
4-C≡CH	OEt	4-Et
4-C=C-Et	OCHF ₂	4-i-Pr
4-OCH ₂ C≡CH	OBu	4- <i>n</i> -Hex
4-NMe ₂	O(CH ₂) ₃ CF ₃	4-c-Pr
4-C (=0) NMe ₂	(CH ₂) ₃ CF ₃	4-CF ₃
4-Ph		4-SMe
4-OPh		4-SBu
4-SPh		4-c-Hex
4-(3-Me-Ph)		4-C1
	•	-

	_	
4-Br	H 3-C1 5-C1	3-0CHF ₂
4-F	C1 H 4-C1	3-0Bu
4-(CH ₂) ₃ CF ₃		3-0 (CH ₂) 3CF3
4-S (O) Me	$G^2=S(0)_2$, $R^{12}=H$,	3-(CH ₂)3CF3
4-S (O) Bu	R ²⁸ =H	
4-S (O) 2Me	R ¹¹	$G^2=S(0)_2$,
4-S (O) 2Bu	н	$R^{11}=R^{12}=H$
4-0Me	Me	R ²⁸
4-OBu	Et	4-Me
4-OCH ₂ CF ₃	i-Pr	4-CN
4-OCH ₂ OMe	s-Bu	4-NO ₂
4-CH ₂ OMe	F	4-он
4-СН=СН-Ме	C1	4-co ₂ H
4-CH=CHCH2Me	Br	4-00 ₂ Et
4-TBS	CF ₃	4-Et
4-SiMe ₃	OMe	4-i-Pr
4-C≡CH	OEt	4- <i>n</i> -Hex
4-C≡C-Et	OCHF ₂	4-c-Pr
4-0CH ₂ C=CH	OBu	4-CF3
4-NMe ₂	O(CH ₂) ₃ CF ₃	4-SMe
4-C (=0) NMe ₂	(CH ₂) ₃ CF ₃	4-SBu
4-Ph		4- <i>c</i> -Hex
4-0Ph	G ² =S(0) ₂ , R ¹¹ =H,	4-C1
4-SPh	_R 28 _{=H}	4-Br
4-(3-Me-Ph)	R ¹²	4-F
	3-Me	4-(CH ₂) ₃ CF ₃
G ² =S (O)	3-Et	4-S (O) Me
R11 R12 R28	3-1-Pr	4-S (O) Bu
CI H 6-CI	3− <i>s−</i> Bu	4-S (O) 2Me
н 3-ме 4-ме	3 - F	4-5 (O) 2Bu
H 3-Me 4-Et	3-C1	4-OMe
H 3-0Me 4-0Me	3-Br	4-OBu
Me H 5-Me	3-CF3	4-0CH ₂ CF ₃
Me H 4-Me	3-OMe	4-OCH2OMe
Me 4-Me 5-Me	3-0Et	4-CH ₂ OMe
		• • • • • • • • • • • • • • • • • • •

	1	•
4-CH=CH-Me	CHF ₂	C (=0) Ph
4-CH=CHCH ₂ Me	(CH ₂) ₃ CF ₃	(3-Me-Ph) C (=0)
4-TBS	CO ₂ Et	(4-OMe-Ph)C(=O)
4-SiMe ₃	C (=0) Me	CH ₂ C=CH ₂
4-C=CH	C (=0) (CH ₂) ₃ Me	CH ₂ C≡CH
4-C≡C-Et	C (=0) Ph	PhCH ₂
4-OCH ₂ C≡CH	(3-Me-Ph)C(=0)	4-Me-PhCH ₂
4-NMe ₂	(4-OMe-Ph)C(=O)	S (0) ₂ Me
4-C (=0) NMe ₂	CH ₂ C=CH ₂	C (=0) NMe ₂
4-Ph	CH ₂ C≡CH	C (=S) NHMe
4-OPh	PhCH ₂	S (0) Me
4-SPh	4-Me-PhCH ₂	S (O) ₂ Ph
4-(3-Me-Ph)	S (O) ₂ Me	(4-Me-Ph) S (0) 2
	C (≕0) NMe ₂	C (=0) NHPh
G ² =S (O) ₂	C (=S) NHMe	C (=S) NHPh
R ¹¹ R ¹² R ²⁸	S (0) Me	P (=S) (OEt) ₂
C1 H 6-C1	S (O) ₂ Ph	P (=0) (OEt) 2
Н 3-ме 4-ме	•(4-Me-Ph)S(0) ₂	S(O) ₂ N(Et) ₂
H 3-Me 4-Et	C (=0) NHPh	
H 3-0Me 4-0Me	C (=S) NHPh	n ¹ =3
Me H 5-Me	P (=S) (OEt) ₂	B ²⁷
Ме н 4-ме	P(=0)(OEt) ₂	н
Me 4-Me 5-Me	S(O) ₂ N(Et) ₂	Et
H 3-C1 5-C1		Bu
C1 H 4-C1	n ¹ =2	i-Pr
	R ²⁷	CHF ₂
TABLE 14	Ħ	(CH ₂) ₃ CF ₃
Compounds of	Et	CO ₂ Et
Formula IIf	Bu	C (=0) Me
n ¹ =1	i-Pr	C (=0) (CH ₂) 3Me
R ²⁷	CHF ₂	C (=0) Ph
Н	(CH ₂) ₃ CF ₃	(3-Me-Ph) C (=0)
Et	CO ₂ Et	(3-Me-Ph)C(=0)
Bu	C (=0) Me	CH ₂ C=CH ₂
i-Pr	C (=0) (CH ₂) ₃ Me	CH ₂ C≌CH
•	= -	- ,

PhCH ₂			1 1	S (O)
4-Me-PhCH ₂	TABLE	15	.1 2	S (O)
S (O) 2 ^{Me}	Compound	sof	2 1	s (O)
C (=0) NMe ₂	Formula	IIg	0 3	s (o)
C (=S) NHMe	n n ¹	<u>G</u> ²	1 1	S (O)
S (0) Me	1 1	s	1 2	S (O)
S(O) ₂ Ph	1 2	s	2 1	s (0)
(4-Me-Ph) S (0) 2	2 1	s	0 : 3	s (0)
C (=0) NHPh	0 3	s	1 1	N-Me
C (=S) NHPh	1 1	0	1 2	N-Me
P (=S) (OEt) 2	1 2	0	2 1	N-Me
P (=0) (OEt) 2	2 1	0		
S(O)2N(Et)2	0 3	.0		•
TABLE 16		1 Me	Me	H H
Compounds of Formu	la IIh	1 H	H	Ме Н
g ² =s		1 H	H	Bu H
n^2 R^1 R^7	R ⁴ R ⁸	1 Ph	H	н н
1 Me H	н н	1 4-Me	-Ph H	н н
1 Bu H	н н	1 4-OM	e-Ph H	н н
1 Me Me	н н	0 Me	H	-
1 H H	Me H	0 Bu	H	
1 H ⁸ H	Bu H	0 Me	Me	
1 Ph H	н н	0 Ph	H	
1 4-Me-Ph H	н и	0 4-Me	-Ph H	<u>-</u>
1 4-OMe-Ph H	н н			
0 Me fi			TABLE 1	L
0 Bu H		· · · · · ·	ds of For	nula IIi
0 Me Me	<u> </u>	G ² =S		<u>.</u>
O Ph H		n ² R ¹	R 2	R3
0 4-Me-Ph H		0 Me	Ħ	inistration — in the
		0 Bu	H	
g ² =0		0 н	Me	
n^2 R^1 R^7	R ⁴ R ⁸	0 н	Bu	
1 Me H	н н	0 Ph	H	
1 Bu H	n n	0 4-Me-P	ь н	

						•	
0	H	4-OMe-Ph		0	H	Me	
n	R ¹	R ²	R ³	0	н	Bu	
1	Me	H	н	0	Ph	н	
1	Bu	H	H	0	4-Me-Ph	Н	
1	• н	Me .	H	0	н :	4-OMe-Ph	
1	н .	Bu	н	1	Me	H 1	H
1	Н	H	Me	1	Bu	H	Н
1	H.	H.	Bu	1	H	Me	н
1	Ph .	Ħ	н	1	н .	Bu	н
1	4-Me-Ph	H	H	1	H	н	Me
1	Н	Ph	н	1	н	H	Bu
1	н .	4-Me-Ph	΄ H	1	Ph	H .	н
1	H	H ,	Ph	1	4-Me-Ph	H	H
·1	H	H	4-Me-Ph	. 1	H	Ph	H
				. 1	н -	4-Me-Ph	H
G ² -	= 0		:	1	н	H	Ph
n^2	R ¹	R ²	R ³	1	H	н	4-Me-Ph
0	Me	Ħ					·
0	Bu	н				+ 2	
							· · · · · · · · · · · · · · · · · · ·

Compounds of Formula IIj

		.compounds or	. FUIMUIA IIJ		
$G^2=S$	e e	•	H	н н	4-OMe-Ph
R ¹	R ⁷ R ⁵	_R 6	Bu	н н	Н
H	H Me	н	3-Me-Ph	н н	Н
H	H Ph	н	4-OMe-Ph	н н	н
H	н н	Me	'G ² =0		
Н	н н	· Ph	R ¹	R ⁷ R ⁵	R ⁶
Me	н н	H	H , , , , , , , , , , , , , , , , , , ,	H Me	H
Me	Ме Н	H	∶H	H Ph	н
Ph	н н	H	H s	н н	Me
н .	Ph H	`, . H , ,	H 3	нн	Ph
H .	H Bu	- ∕H	, Me	н	. н
H	H 4-Me-Р	ħН	Me l	Me H	H
н	н н	Bu	Ph I	н н	н

•			4			
H	Ph	H	н	H	1-Pr	H
н	H	Bu	H :	2-C1	H	H
H	н	4-Me-Ph	н	3-C1	н	H
н	H	Ħ	Bu	н	CI	H
H	H	H	4-OMe-Ph	3-Me	Me	H
Bu	H	H 2	Ħ	2- M e	H	5-Me
3-Me-Ph	H	H	H	2-C1	H	6-C1
4-OMe-Ph	H	н .	Ħ	<u>.</u>		
		•		$G_2=0$, MC1	=ZnCl ₂	
	1	TABLE 19		R ¹¹	R ¹²	R ²⁸
Compound	s of	Formula	IVc	Ħ	Me	H
G ²		n	n ¹	н	Et	H
S		1 1 1 1	1	H	OMe	H
S	٠	1	2	H	i-Pr	H
S		2 ,	i	2-C1	H ·	H
· O · ·		1	. 1	3-C1	H	H
o 39		1	2	н	Cl	H
0		2	1	3-Me	Me	H
S (O)		1	1 .	2-Me	H .	5-Me
s (o)		1	2	2-C1	H	6-C1
S (O)		2	jan ja <mark>k</mark> kuns			
s(0) ₂		1	10 to	G ₂ =S, MCl ₂		
s(0) ₂	·	1	2	R ¹¹	R ¹²	R ²⁸
S(0) ₂		2	1	H	Me	H.
NMe		1 4	4 i	B	Et	H
NMe		1 (1)	. 2	≇H € €	OMe	н
NMe .		2	** 1	H (5)	i-Pr	H
	•			2-C1	Ħ	H
		TABLE 20	Ĺ	3-C1	1. H () () () ()	H
Compound	s of	Formula	Im	H	CI	H
G ₂ =S, MC	-			3-Me	Me	H
R ¹¹	• . •	R ¹²	R ²⁸	2-Me	H	5-Me
H	£'	Me	H.	2-C1	Ħ	6-CI
H	<u>ب</u>	Et .	M H			
TH (OMe	a			
			•			

G ₂ =O, MCl	=FeCla	1	3-Me	Me	н .
B ¹¹	R ¹²	R ²⁸	2-Me	Н	5-Me
H ·	.Me	Я	2-C1	H	6-C1
	Et	н	2-01	n	0.01
H	·		C -C MG3	-M-G1	
H 	OMe	H	$G_2=S$, MCl_x R^{11}	R ¹²	R ²⁸
Н	i-Pr	H			
2-C1	Н	Н	H	Ме	H
3-C1	H	H	H	Et	H
Н	Cl	н	H	OMe	H
3-Me	Me	H ;	.H .	i-Pr	Н
2-Me	н	5-Me	2-C1	Н	H
2-C1	н	6-C1	3-C1	H	H
	•		H	Cl	H
G ₂ =S, MCl			3-Me	Me	H.
<u>R</u> 11	R ¹²	R ²⁸	2-Me	н	5-Me
- H	Me	H	2-C1	Н	6-C1
H .	Et .	н	en e		-
H .	OMe	н	G2=0, MClx	=MnCl ₂	
H	1-Pr	н	R ¹¹	R ¹²	R ²⁸
2-C1	H	H	ы н	Me	Ħ
3-C1	H	н	н	Et	н
H	C1	н	H	OMe	·H
3-Ме	Me	н	н	1-Pr	н
2-Me	Ħ	5-Me	2-C1	н	н
2-C1	H	6-C1	3-C1	н	H
essential			H	C1	н
G2=0, MCl	-CuCl ₂		3-Me	Me	Ħ
R ¹¹	R ¹²	R ²⁸	2-Me	Ħ	5-Me
H	Me	н	2-C1	H	6-C1
н	Et	н			
•	OMe	H	G ₂ =S, MCl _x	-MgCl ₂	•
H	i-Pr		R ¹¹	B ¹²	R ²⁸
2-C1	H	H H	H .	Me	H
3-C1	н	н	H	Et.	н
		. 4			
H	C1	H	Н	OMe	H

· 1	

		· •	-		
H	i-Pr	н	H	Et	H
2-C1	Ħ	н	н	OMe	H
3-C1	H	н	н	i-Pr	H
н	Cl	н	2-C1	H	н
3-Me	Me	н	3-C1	н	H
2-Me	H	5-Me	н	Cl	H
2-C1	H	6-C1	3-Me	Me	H.
		_	2-Me	н	5-Me
G2=0, MClx	-MgCL ₂		2-C1	·H	6-C1
R ¹¹	R ¹²	R ²⁸	7 v		•
H	_ Me	H			

Formulation/Utility

Compounds of this invention will generally be used in formulation with an agriculturally suitable composition. The fungicidal compositions of the present invention comprise an effective amount of at least one compound of Formula I as defined above and at least one of (a) a surfactant, (b) an organic solvent, and (c) at least one solid or liquid diluent. Useful formulations can be prepared in conventional ways. 10 They include dusts, granules, pellets, solutions, suspensions, emulsions, wettable powders, emulsifiable concentrates, dry flowables and the like. Sprayable formulations can be extended in suitable media and used at spray volumes from about one to several hundred 15 liters per hectare. High strength compositions are primarily used as intermediates for further formulation. The formulations will typically contain effective amounts of active ingredient, diluent and surfactant within the following approximate ranges 20 which add up 100 weight percent.

general experience of the second	Weight Percent				
	Active Ingredient	Diluent	Surfactant		
Wettable Powders	25-90	0-74	1-10		
Oil Suspensions, Emulsions, Solutions, (including Emulsifiable Concentrates)	5-50	40-95	0-15		
Dusts	1-25	70-99	0-5		
Granules, Baits and Pellets	0.01-99	5-99.99	0-15		
High Strength Compositions	90-99	0-10	0-2		

Typical solid diluents are described in Watkins, et al., Handbook of Insecticide Dust Diluents and Carriers, 2nd Ed., Dorland Books, Caldwell, New Jersey.

Typical liquid diluents and solvents are described in Marsden, Solvents Guide, 2nd Ed., Interscience, New York, 1950. McCutcheon's Detergents and Emulsifiers Annual, Allured Publ. Corp., Ridgewood, New Jersey, as well as Sisely and Wood, Encyclopedia of Surface Active Agents, Chemical Publ. Co., Inc., New York, 1964, list surfactants and recommended uses. All formulations can contain minor amounts of additives to reduce foam, caking, corrosion, microbiological growth, etc.

Methods for formulating such compositions are well known. Solutions are prepared by simply mixing the ingredients. Fine solid compositions are made by blending and, usually, grinding as in a hammer mill or fluid energy mill. Water-dispersible granules can be produced be agglomerating a fine powder composition; see for example, Cross et al., Pesticide Formulations, Washington, D.C., 1988, pp 251-259. Suspensions are prepared by wet-milling; see, for example, U.S. 3,060,084. Granules and pellets can be made by

spraying the active material upon preformed granular carriers or by agglomeration techniques. See Browning, "Agglomeration", Chemical Engineering, December 4, 1967, pp 147-148, Perry's Chemical Engineer's Handbook, 4th Ed., McGraw-Hill, New York, 1963, pp 8-57 and following, and WO 91/13546. Pellets can be prepared as described in U.S. 4,172,714. Water-dispersible and water-soluble granules can be prepared as taught in DE 3,246,493.

10 For further information regarding the art of formulation, see U.S. 3,235,361, Col. 6, line 16 through Col. 7, line 19 and Examples 10 through 41; U.S. 3,309,192, Col. 5, line 43 through Col. 7, line 62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132,

15 138-140, 162-164, 166, 167 and 169-182; U.S.
2,891,855, Col. 3, line 66 through Col. 5, line 17 and
Examples 1-4; Klingman, Weed Control as a Science, John
Wiley and Sons, Inc., New York, 1961, pp 81-96; and
Hance et al., Weed Control Handbook, 8th Ed., Blackwell
20 Scientific Publications, Oxford, 1989.

In the following Examples, all percentages are by weight and all formulations are worked up in conventional ways. Compound numbers refer to Index Table A hereinafter.

25 Example A

Wettable Powder

Compound 11	65.0%
dodecylphenol polyethylene	glycol ether 2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example B

<u>Granule</u>

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Compound 11

35 attapulgite granules (low volative

	matter, 0.71/0.30 mm; U.S.S. No.	
	25-50 sieves)	90.0%.
	Example C	
	Extruded Pellet	
5	Compound 11	25.0%
	anhydrous sodium sulfate	10.0%
	crude calcium ligninsulfonate	5.0%
	sodium alkylnaphthalenesulfonate	1.0%
	calcium/magnesium bentonite	59.0%.
10	Example D	
	Emulsifiable Concentrate	•
	Compound 11	20.0%
	blend of oil soluble sulfonates	,
	and polyoxyethylene ethers	10.0%
15	isophorone	70.0%.
	The compounds of this invention are t	seful as plant
	disease control agents. The present inve	ention
	therefore further comprises a method for	controlling
	plant diseases caused by fungal plant pat	chogens
20	comprising applying to the plant or ports	
	be protected, or to the plant seed or see	edling to be
	protected, an effective amount of a compo	
	I or a fungicidal composition containing	· · · · ·
	The compounds and compositions of this in	+ f
25	provide control of diseases caused by a h	N.T. ()
٠. ٠.	of fungal plant pathogens in the Basidion	The Carlotte of the Carlotte o
	Ascomycete, Oomycete and Deuteromycete cl	· · · · · · · · · · · · · · · · · · ·
	are effective in controlling a broad spec	• • • • • • • • • • • • • • • • • • •
÷0	diseases, particularly foliar pathogens of	
30	vegetable, field, cereal, and fruit crops	
	pathogens include Plasmopara viticola, Pl	
	infestans, Peronospora tabacina, Pseudope	and the state of t
•	cubensis, Pythium aphanidermatum, Alterna	the second secon
~ -	Septoria nodorum, Cercosporidium personat	
35	arachidicola, Pseudocercosporella herpoti	cichoides,

Cercospora beticola, Botrytis cinerea, Monilinia fructicola, Pyricularia oryzae, Podosphaera leucotricha, Venturia inaequalis, Erysiphe graminis, Uncinula necatur, Puccinia recondita, Puccinia graminis, Hemileia vastatrix, Puccinia striiformis, Puccinia arachidis, Rhizoctonia solani, Sphaerotheca fuliginea, Fusarium oxysporum, Verticillium dahliae, Pythium aphanidermatum, Phytophthora megasperma and other generea and species closely related to these pathogens.

Compounds of this invention can also be mixed with one or more other insecticides, fungicides, nematocides, bactericides, acaricides, semiochemicals, repellants, attractants, pheromones, feeding stimulants or other biologically active compounds to form a multicomponent pesticide giving an even broader spectrum of agricultural protection. Examples of other agricultural protectants with which compounds of this invention can be formulated are: insecticides such as monocrotophos, carbofuran, tetrachlorvinphos, malathion, parathion-methyl, methomyl, chlordimeform, diazinon, deltamethrin, oxamyl, fenvalerate, esfenvalerate, permethrin, profenofos, sulprofos, triflumuron, diflubenzuron, methoprene, buprofezin, thiodicarb, acephate, azinphosmethyl, chlorpyrifos, dimethoate, fipronil, flufenprox, fonophos, isofenphos, methidathion, methamidophos, phosmet, phosphamidon, phosalone, pirimicarb, phorate, terbufos, trichlorfon, methoxychlor, bifenthrin, biphenate, cyfluthrin, fenpropathrin, fluvalinate, flucythrinate, tralomethrin, metaldehyde and rotenone; fungicides such as carbendazim, thiuram, dodine, maneb, chloroneb, benomyl, cymoxanil, fenpropidine, fenpropimorph, triadimefon, captan, thiophanate-methyl, thiabendazole, phosethyl-Al, chlorothalonil, dichloran, metalaxyl,

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captafol, iprodione, oxadixyl, vinclozolin, kasugamycin, myclobutanil, tebuconazole, difenoconazole, diniconazole, fluquinconazole, ipconazole, metconazole, penconazole, propiconazole, uniconzole, flutriafol, prochloraz, pyrifenox, fenarimol, triadimenol, diclobutrazol, copper oxychloride, furalaxyl, folpet, flusilazol, blasticidin S, diclomezine, edifenphos, isoprothiolane, iprobenfos, mepronil, neo-asozin, pencycuron, 10 probenazole, pyroquilon, tricyclazole, validamycin, and flutolanil; nematocides such as aldoxycarb, fenamiphos and fosthietan; bactericides such as oxytetracyline, streptomycin and tribasic copper sulfate; acaricides such as binapacryl, oxythioquinox, chlorobenzilate, 15 dicofol, dienochlor, cyhexatin, hexythiazox, amitraz, propargite, tebufenpyrad and fenbutatin oxide; and biological agents such as Bacillus thuringiensis, baculovirus and avermectin B.

In certain instances, combinations with other fungicides having a similiar spectrum of control but a different mode of action will be particularly advantageous for resistance management.

Plant disease control is ordinarily accomplished by applying an effective amount of a compound of this invention either pre— or post—infection, to the portion of the plant to be protected such as the roots, stems, foliage, fruit, seeds, tubers or bulbs, or to the media (soil or sand) in which the plants to be protected are growing. The compounds can also be applied to the seed to protect the seed and seedling.

Rates of application for these compounds can be influenced by many factors of the environment and should be determined under actual use conditions. Foliage can normally be protected when treated at a rate of from less than 1 g/ha to 5,000 g/ha of active

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ingredient. Seed and seedlings can normally be protected when seed is treated at a rate of from 0.1 to 10 g per kilogram of seed.

The following Tests demonstrate the control efficacy of compounds of this invention on specific pathogens. The pathogen control protection afforded by the compounds is not limited, however, to these species. See Index Table A for compound descriptions.

Test compounds were first dissolved in acetone in an amount equal to 3% of the final volume and then suspended at a concentration of 200 ppm in purified water containing 250 ppm of the surfactant Trem® 014 (polyhydric alcohol esters). The resulting test suspensions were then used in the following tests.

TEST A

The test suspension was sprayed to the point of run-off on wheat seedlings. The following day the seedlings were inoculated with a spore dust of Erysiphe graminis f. sp. tritici, (the causal agent of wheat powdery mildew) and incubated in a growth chamber at 20°C for 7 days, after which disease ratings were made.

TEST B

The test suspension was sprayed to the point of run-off on wheat seedlings. The following day the seedlings were inoculated with a spore suspension of *Puccinia recondita* (the causal agent of wheat leaf rust) and incubated in a saturated atmosphere at 20°C for 24 h, and then moved to a growth chamber at 20°C for 6 days, after which disease ratings were made.

30 TEST C

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The test suspension was sprayed to the point of run-off on rice seedlings. The following day the seedlings were inoculated with a spore suspension of *Pyricularia oryzae* (the causal agent of rice blast) and incubated in a saturated atmosphere at 27°C for 24 h,

and then moved to a growth chamber at 30°C for 5 days, after which disease ratings were made.

TEST D

The test suspension was sprayed to the point of run-off on tomato seedlings. The following day the seedlings were inoculated with a spore suspension of *Phytophthora infestans* (the causal agent of potato and tomato late blight) and incubated in a saturated atmosphere at 20°C for 24 h, and then moved to a growth chamber at 20°C for 5 days, after which disease ratings were made.

TEST E

The test suspension was sprayed to the point of run-off on grape seedlings. The following day the seedlings were inoculated with a spore suspension of *Plasmopara viticola* (the causal agent of grape downy mildew) and incubated in a saturated atmosphere at 20°C for 24 h, moved to a growth chamber at 20°C for 6 days, and then incubated in a saturated atmosphere at 20°C for 24 h, after which disease ratings were made.

TEST F

The test suspension was sprayed to the point of run-off on cucumber seedlings. The following day the seedlings were inoculated with a spore suspension of Botrytis cinerea (the causal agent of gray mold on many crops) and incubated in a saturated atmosphere at 20°C for 48 h, and moved to a growth chamber at 20°C for 5 days, after which disease ratings were made.

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Index Table 1
Compounds of Formula I

$R^{9}=R^{10}=Me;$	X=CH; Y=N					
Cmpd. No.	G ¹ -G ² -G ³	E	mp (°C)			
1	CH ₂ OCH ₂	Ph	a ·			
2	CH ₂ CH ₂ S	4-C1-Ph	a			

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		•	•	
3	•	CH ₂ OCH ₂	4-Et-Ph	a
4		CH ₂ CH ₂ O	3-Me-Ph	a
5	•	CH ₂ CH ₂ S	3-Me-Ph	a
6		CH ₂ CH ₂ O	2,6-diCl-Ph	a
7		CH ₂ CH ₂ S	4-Me-Ph	a
8		CH ₂ CH ₂ S	2-C1-Ph	146-148
9	•	CH ₂ CH ₂ S	3-C1-Ph	a
10	-	CH ₂ CH ₂ O	4-Et-Ph	99-106
11	** . · ·	CH ₂ CH ₂ S	4-Et-Ph	84-87
12		CH ₂ CH ₂ SO	2-CI-Ph	168-170
13	•	CH ₂ CH ₂ S	Ph	142-145
14		CH ₂ CH ₂ S	3-CF ₃ -Ph	105-110
15	<u> </u>	CH ₂ CH ₂ S	4-OMe-Ph	111-115
16		CH ₂ CH ₂ SO	4-Et-Ph	149-164
17		CH ₂ CH ₂ SO ₂	4-Et-Ph	139-141
18		CH ₂ CH ₂ S	4-t-Bu	114-121
19		CH2CH2CH2S	4-OMe-Ph	119-123
20		CH ₂ CH ₂ S	OPh	75-85
21	1. M. C. 11. 11. 11. 11. 11. 11. 11. 11. 11.	CH2CH2CH2S	4-Et-Ph	97-100
22	ranga e	CH (CH ₃) CH ₂ S	4-Et-Ph	а
23	1	CH ₂ CH ₂ S	2-Me-Ph	86-91
24		CH ₂ CH ₂ S	OBz1	81-93
25		CH ₂ CH ₂ S	SPh	a
26		CH ₂ CH ₂ S	Bzl	а
27		CH ₂ CH ₂ CH ₂ S	Ph	158-160
28	· · · · · ·	CH (CH ₃) CH ₂ S	Ph	а
29		CH ₂ C (CH ₃) ₂ CH ₂ S	Ph. Stranger	116-121
30		CH ₂ CH (Ph) S	Ph	196-208
31		CH ₂ CH ₂ S	Et	a
32		CH ₂ CH (CO ₂ Et) S	Ph	124-133
33	· ·	CH ₂ CH (Ph) SO ₂	Ph	201-206
34			Ph	174-181
35		CH (CH2CH3) CH2S	Ph	a
36		CH ₂ CH (CN) S	Ph	208-212
37	,	CH (CN) CH ₂ S	Ph	168-174

38	CH ₂ CH ₂ S	3,4-diCl-Ph	149-152
39	CH ₂ CH ₂ S	4-Ph-Ph	151-155
40	CH ₂ CH ₂ S	3,4-diOMe-Ph	172-174

a Oil or gum; ¹H NMR data in Index Table 2.

 $X=CR^{13}$; R^9 and R^{13} are taken together to form a fused benzene ring; Y=N; $R^{10}=Me$

Cmpd.	No.	G ¹ -G ² -G ³	E		mp (°C)
38		CH ₂ CH ₂ s	Ph	•	102-108

R9=R10=ethyl; X=CH; Y=N

Cmpd. No.	G ¹ -G ² -G ³	E	mp (°C)
39	CH ₂ CH ₂ S	Ph	oil; ¹ H
			NMR data
			in Index
	•		Table 2.

Index Table 2

			1110	lex Tab	e_2			
_	Cmpd.	No.	·	1 _H	NMR	Dataa	·	
	• • • • • • • • • • • • • • • • • • • •	7.75	(m, 2H), 7.37	(m,	3H), 6.57	(s, 1H),	
		5.54	(s, 2H), 4.83	(s.,	2H), 2.42	(s, 6H).	
	2	7.83	(d, 2H	7.35	ďd,	2Н), 6.56	(s, 1H),	
		4.47	(t, 2H	3.36	(t,	2H), 2.43	(s, 6H).	
-	3	7.66	(d, 2H	7.21	(d,	2H), 6.56	(s, 1H),	
	-	5.54	(s, 2H)	4.81	(s,	2H), 2.67	(q, 2H),	
		2.42	(s, 6H	1.24	(t,	Зн).		
	4	7.82	(m, 1H)	7.75	(m,	1H), 7.25	(m, 1H),	
						1H), 4.54		
		4.28	(m, 2H)	, 2.42	(s,	6H), 2.38	(s, 3H).	
	-5	7.7	(m, 2H)	, 7.2 (1	n, 21	H), 6.54 (s, 1H),	
		4.45	(m, 2H)	3.35	(m,	2H), 2.42	(s, 6H),	٠.
		2.39	(s, 3H)) . * :		Contract Contract		
	6	7.31	(m, 2H)	7.25	(m,	1H), 6.5	(s, 1H),	
	4	4.55	(m, 2H)	4.35	(m,	2H), 2.38	(s, 6H).	

```
7.77 (d, 2H), 7.18 (d, 2H), 6.53 (s, 1H),
        4.46 (m, 2H), 3.35 (m, 2H), 2.42 (s, 6H),
        2.37 (s, 3H).
        7.90 (m, 1H), 7.75 (m, 1H), 7.3 (m, 2H),
        6.57 (s, 1H), 4.47 (m, 2H), 3.36 (m, 2H),
        2.43 (s, 6H).
        7.82 (d, 2H), 7.22 (d, 2H), 6.52 (s, 1H),
22
        5.7 (m, 1H), 3.45 (d, 1H), 3.00 (d, 1H),
        2.7 (q, 2H), 2.42 (s, 6H), 1.38 (d, 3H),
        1.24 (t, 3H).
        7.65 (m, 2H), 7.34 (m, 3H), 6.55 (s, 1H),
25
        4.40 (m, 2H), 3.25 (m, 2H), 2.41 (s, 6H).
        7.37 (d, 2H), 7.32 (t, 2H), 7.25 (d, 1H),
26
        6.51 (s, 1H), 4.32 (m, 2H), 3.89 (s, 2H),
        3.19 (m, 2H), 2.41 (s, 6H).
        7.93 (d, 2H), 7.37 (m, 3H), 6.54 (s, 1H),
28
        5.7 (m, 1H), 3.45 (d, 1H), 3.02 (m, 1H),
        2.42 (s, 6H), 1.40 (d, 3H).
31
        6.48 (s, 1H), 4.33 (t, 2H), 3.25 (t, 2H),
        2.58 (g, 2H), 2.39 (s, 6H), 1.26 (t, 3H).
        7.85 (d, 2H), 7.37 (m, 3H), 6.52 (s, 1H),
35
        5.50 (m, 1H), 3.38 (d, 1H), 3.20 (d, 1H),
        2.41 (s, 6H), 1.80 (m, 2H), 0.99 (t, 3H).
        7.85 (d, 2H), 7.37 (m, 3H), 6.56 (s, 1H),
39
        4.45 (m, 2H), 3.35 (m, 2H), 2.72 (q, 4H),
        1.31 (t, 6H).
```

silane. Coupling are designated (s)-singlet, (d)-doublet, (t)-triplet, (q)-quartet, (m)-multiplet. Samples were dissolved in CDCl₃.

Results for Tests A-F are given in Table A. In the table, a rating of 100 indicates 100% disease control and a rating of 0 indicates no disease control (relative to the controls). NT = Not Tested.

Table A

		1	Table	<u></u> A.	•		
Cmpd No.	Test A	Test B	Test C	Test D	Test E	Test F	
1	98	100	65	23	75	65	
2	76	93	99	11	91	2	
3	86*	84*	72*	59*	44	77	
4	73*	64*	73*	36*	0*	32*·	
5	24*	64*	73*	10*	·0 *	32*	
6	0*	0*	29*	0*	86*	46*	
8	0	80	85	3	100	98	
. 9	98	100	99	82	92	98	
10	94	100	99	52	85	82	
11	99	100	97	52	92	98	
12	56	0	0	60	92	0	
13	98	96	91	91	100	77	
14	98	82	100	73	100	47	
15	96	98	97	0	100	98 -	
16	82	0	. 0	0	13	0	
17	61	14	0	NT	14	0	
18	82	. • 0	86	· O	.73	83	
19	29	21	57	18	96	99	
20	90	98	99	85	99	99	
21	98	98	94	0	100	69	
22	0	55 ,	91	58	100	0	
23	74	100	94	73	100	80	
24	83 -	91	32	63	84	0	
25	90	100	91	63	100	70	
26	92	98	. 85	70	100	46	
27	55	23	91	14	74	98	
28	56*	96	91	0	100	94	
29.	52	. 80	74	22*	92	94	
30	.0.	55	0 .	22	99	66	
31	89	5 5	0	44	0	66	
32	0	0	0	0	99	82	
33	0*	54*	0*	0*	9*	34*	
34	0*	54*	0*	0*.	0*	0*	

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39	98	83	91	0	100	90	
38	29	93	•97	23	96	, O	

^{*=}Applications of the compound was made at a rate of 40 ppm.

What is claimed is:

1. The compounds of Formulae I, II, III and IV,

wherein:

 $-G^1-G^2-G^3-$ taken together with the attached atoms 10 form a 5-8 membered ring, wherein $-G^{1}-$ is $-CR^{1}R^{7}-$; $-(CHR^{1}CHR^{2})-$; $-(CHR^{1}CHR^{2}CHR^{3})-$; or - (CHR1CHR2CHR3CHR4) -; $-G^2-is$ -O-; -S-; -S(O)-; -S(O)₂- or -NR²⁷-; $-G^3$ -is $-CR^4R^8$ -; $-(CHR^5CHR^6)$ -; $-(CHR^3CHR^5CHR^6)$ - or a 15 direct bond; X is N or CR13; Y is N or CR14; E is H; C₁-C₆ alkyl; C₃-C₇ cycloalkyl optionally substituted with 1-2 methyl; C_1-C_6 haloalkyl; 20 C_1-C_6 alkylthio; C_1-C_6 alkoxy; C_1-C_6 haloalkoxy; or phenyl, phenoxy, phenylthio, phenylamino,

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phenylmethyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, 2-naphthalenyl, thienyl, furanyl or pyridyl each optionally substituted with R^{11} , R^{12} and R^{28} ;

R¹, R², R³, R⁴, R⁵, R⁶, R⁷ and R⁸ are each independently H; C₁-C₄ alkyl; C₁-C₄ haloalkyl, halogen, CO₂CH₃, CO₂CH₂CH₃, cyano or phenyl optionally substituted with R²⁵;

provided that

- 10 (i) the maximum number of carbon atoms in $-G^{1}-G^{2}-G^{3}-\text{ with geminal disubstitution}$ is one;
 - (ii) the maximum number of optionally substituted phenyl substituents on $-G^{1}-G^{2}-G^{3}-$ is one;
 - (iii) -G³- is other than a direct bond in compounds of Formulae III and IV; and
 - (iv) $-G^2-G^3-$ is other than $-NR^{27}-$ in compounds of Formulae I and II;
 - R⁹, R¹⁰ and R¹³ are each independently H; halogen; cyano; hydroxy; C₁-C₆ alkyl; C₁-C₄ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkylsulfinyl; C₁-C₄ alkylsulfonyl; C₃-C₆ cycloalkyl optionally substituted with 1-2 methyl groups; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₄ alkenyl; C₂-C₄ haloalkenyl; C₂-C₄ alkynyloxy; NR²⁹R³⁰; or phenyl or phenoxy optionally substituted with R³¹; or
- 30 R⁹ and R¹³, or R¹⁰ and R¹³, or R⁹ and R¹⁴ can be taken together to form $-(CH_2)_3$, $-(CH_2)_4$ or a fused benzene ring optionally substituted with R³¹;

	\mathbb{R}^{11} , \mathbb{R}^{12} , \mathbb{R}^{21} , \mathbb{R}^{24} , \mathbb{R}^{26} and \mathbb{R}^{31} are each
	independently halogen; C1-C4 alkyl; C1-C4
	haloalkyl; C_1-C_4 alkoxy; or C_1-C_4 haloalkoxy;
	R^{14} is H; halogen; C_1-C_2 alkyl; or C_1-C_2 alkoxy;
5	R^{15} , R^{16} , R^{17} , R^{18} , R^{29} and R^{30} are each
	independently H or C1-C2 alkyl; or
	R^{15} and R^{16} , or R^{17} and R^{18} , or R^{29} and R^{30} can be
	taken together along with the nitrogen atom to
•	which they are attached to form a
10	4-morpholinyl, pyrrolidinyl or piperidinyl
•	ring;
-	R^{20} and R^{27} are each independently H; C_1-C_4 alkyl;
•	C ₁ -C ₄ haloalkyl; C ₂ -C ₅ alkylcarbonyl; phenyl-
	carbonyl optionally substituted with R21; C3-C
15	alkenyl; C ₃ -C ₄ alkynyl; phenylmethyl optionall
	substituted with R^{21} on the phenyl ring; C_1-C_4
	alkylsulfinyl; C ₁ -C ₄ alkylsulfonyl; phenyl-
	sulfinyl, phenylsulfonyl or phenoxycarbonyl
	each optionally substituted with R ²¹ ; C ₂ -C ₄
20	alkoxycarbonyl; C(=0) NR ²² R ²³ ; C(=S) NHR ²³ ;
	$P(=S) (C_1-C_4 \text{ alkoxy})_2$; $P(=0) (C_1-C_4 \text{ alkoxy})_2$; or
	$S(=0)_2NR^{22}R^{23};$
	R^{22} is H or C_1-C_3 alkyl;
•	R^{23} is C_1-C_4 alkyl; or phenyl optionally
25	substituted with R24; or
	\mathbb{R}^{22} and \mathbb{R}^{23} can be taken together along with the
1	nitrogen atom to which they are attached to
	form a 4-morpholinyl, pyrrolidinyl, piperidiny
	or imidazolyl ring;
30	R^{25} is 1-2 halogen; C_1-C_4 alkyl; C_1-C_4 haloalkyl;
	C ₁ -C ₄ alkoxy; C ₁ -C ₄ haloalkoxy; nitro; cyano or
	C ₁ -C ₄ alkylthio; and
	R ²⁸ is halogen; cyano; nitro; hydroxy; hydroxy-
·	carbonyl; C ₁ -C ₆ alkyl; C ₃ -C ₆ cycloalkyl; C ₁ -C ₆
35	haloalkyl; C ₁ -C ₄ alkylthio; C ₁ -C ₄ alkyl-

sulfinyl; C_1 - C_4 alkylsulfonyl; $(C_1$ - C_4 alkyl)₃silyl; C_2 - C_5 alkylcarbonyl; C_2 - C_4 alkenyl; C_3 - C_4 alkenyloxy; C_2 - C_4 alkynyloxy; C_1 - C_4 alkoxy; C_1 - C_4 haloalkoxy; C_2 - C_4 alkoxyalkyl; C_2 - C_5 alkoxycarbonyl; C_2 - C_4 alkoxyalkoxy; $NR^{15}R^{16}$; C (=0) $NR^{17}R^{18}$; or phenyl, phenoxy or phenylthic each optionally substituted with R^{26} ;

provided that

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when E is, C_1 - C_6 alkylthio, C_1 - C_6 alkoxy, C_1 - C_6 haloalkoxy, phenoxy, phenylthio or phenylamino, then E may only substitute compounds of Formula I.

and agriculturally suitable salts and metal complexes thereof.

- 2. The compounds of Claim 1, Formula I, wherein: Y is N;
 - E is phenyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, thienyl, or pyridyl each optionally substituted with R¹¹, R¹² and R²⁸;

 R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 and R^8 are each independently H or methyl;

R¹¹ and R¹² are each independently F, Cl, methyl, trifluoromethyl, methoxy or trifluoromethoxy;

R¹³ is H;

- R^9 and R^{10} are each independently halogen; C_1-C_4 alkyl; cyclopropyl; C_1-C_4 haloalkyl; allyl; or C_2-C_3 alkynyl; or
- R^9 and R^{13} can be taken together to form a fused benzene ring optionally substituted with R^{31} :
 - R^{28} is halogen; cyano; C_1-C_4 alkyl; C_1-C_4 haloalkyl; allyl; propargyl; C_1-C_4 alkoxy;

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 C_1-C_4 haloalkoxy; or phenyl or phenoxy each optionally substituted with R^{26} ; and R^{31} is halogen; C_1-C_4 alkyl or C_1-C_4 haloalkyl.

- 3. The compounds of Claim 2, wherein:
 G² is 0; S or NR²⁷; and
 E is phenyl optionally substituted with R¹¹, R¹²
 and R²⁸; indanyl or tetrahydronaphthalenyl.
- 4. The compounds of Claim 3, wherein: $G^{2} \text{ is 0; S; NH or N(C}_{1}-C_{4} \text{ alkyl); and}$ 10 E is phenyl optionally substituted with R^{11} , R^{12} and R^{28} .
 - 5. The compound of Claim 1, which is 3-(4,6-dimethyl-2-pyrimidinyl)-3,6-dihydro-5-phenyl-2H-1,3,4-oxadiazine.
- 6. The compound of Claim 1, which is 3-(4,6-dimethyl-2-pyrimidinyl)-5-(4-ethyl-phenyl)-3,6-dihydro-2H-1,3,4-oxadiazine.
 - 7. The compound of Claim 1, which is 2-(2-chlorophenyl)-4-(4,6-dimethyl-2-pyrimidinyl)-5,6-dihydro-4H-1,3,4-thiadiazine.
 - 8. The compound of Claim 1, which is 4-(4,6-dimethyl-2-pyrimidinyl)-2-(4-ethyl-phenyl)-5,6-dihydro-4H-1,3,4-thiadiazine.
- 9. A method of controlling fungus disease in plants
 which comprises treating the locus to be protected with
 an effective amount of at least one of the compounds of
 Formulae I, II, III or IV, agriculturally suitable
 salts thereof, agriculturally suitable metal complexes
 thereof, or agricultural compositions containing them;

5 wherein:

 $-G^1-G^2-G^3-$ taken together with the attached atoms form a 5-8 membered ring, wherein

-G¹-is -CR¹R⁷-; -(CHR¹CHR²)-; -(CHR¹CHR²CHR³)-; or -(CHR¹CHR²CHR³CHR⁴)-;

10 $-G^2$ - is -O-; -S-; -S(O)-; -S(O)₂- or -NR²⁷-;

-G³- is -CR⁴R⁸;- -(CHR⁵CHR⁶)-; -(CHR³CHR⁵CHR⁶)- or a direct bond;

X is N or CR13;

Y is N or CR14;

E is H; C₁-C₆ alkyl; C₃-C₇ cycloalkyl optionally substituted with 1-2 methyl; C₁-C₆ haloalkyl; C₁-C₆ alkylthio; C₁-C₆ alkoxy; C₁-C₆ haloalkoxy; or phenyl, phenoxy, phenylthio, phenylamino, phenylmethyl, indanyl, tetrahydronaphthalenyl, 1-naphthalenyl, 2-naphthalenyl, thienyl,

furanyl or pyridyl each optionally substituted with R¹¹, R¹² and R²⁸;

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R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 and R^8 are each
independently H; C_1-C_4 alkyl; C_1-C_4 haloalkyl,
halogen, CO ₂ CH ₃ , CO ₂ CH ₂ CH ₃ , cyano, or phenyl
optionally substituted with R25;
provided that
(i) the maximum number of carbon atoms in
-G1-G2-G3- with cominal disubstitution

- (ii) the maximum number of optionally substituted phenyl substituents on $-G^1-G^2-G^3$ is one;
- (iii) -G³- is other than a direct bond in compounds of Formulae III and IV; and
- (iv) $-G^2-G^3$ is other than $-NR^{27}$ in compounds of Formulae I and II;
- R⁹, R¹⁰ and R¹³ are each independently H; halogen; cyano; hydroxy; C₁-C₆ alkyl; C₁-C₄ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkylsulfinyl; C₁-C₄ alkylsulfonyl; C₃-C₆ cycloalkyl optionally substituted with 1-2 methyl groups; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₄ alkenyl; C₂-C₄ haloalkenyl; C₂-C₄ alkenyloxy; C₂-C₄ alkynyl; C₂-C₄ alkynyloxy; NR²⁹R³⁰; or phenyl or phenoxy optionally substituted with R³¹; or
- R^9 and R^{13} , or R^{10} and R^{13} , or R^9 and R^{14} can be taken together to form $-(CH_2)_3-$, $-(CH_2)_4-$ or a fused benzene ring optionally substituted with R^{31} ;
- 30 R¹¹, R¹², R²¹, R²⁴, R²⁶ and R³¹ are each independently halogen; C₁-C₄ alkyl; C₁-C₄ haloalkyl; C₁-C₄ alkoxy; or C₁-C₄ haloalkoxy; R¹⁴ is H; halogen; C₁-C₂ alkyl; or C₁-C₂ alkoxy; R¹⁵, R¹⁶, R¹⁷, R¹⁸, R²⁹ and R³⁰ are each independently H or C₁-C₂ alkyl; or

R ¹⁵	and R^{16} , or R^{17} and R^{18} , or R^{29} and R^{30} can be
•	taken together along with the nitrogen atom to
;	which they are attached to form a 4-morpho-
	linyl, pyrrolidinyl or piperidinyl ring;

R²⁰ and R²⁷ are each independently H; C₁-C₄ alkyl; C₁-C₄ haloalkyl; C₂-C₅ alkylcarbonyl; phenylcarbonyl optionally substituted with R²¹; C₃-C₄ alkenyl; C₃-C₄ alkynyl; phenylmethyl optionally substituted with R²¹ on the phenyl ring; C₁-C₄ alkylsulfinyl; C₁-C₄ alkylsulfonyl; phenylsulfinyl, phenylsulfonyl or phenoxycarbonyl each optionally substituted with R²¹; C₂-C₄ alkoxycarbonyl; C(=0)NR²²R²³; C(=S)NHR²³; P(=S)(C₁-C₄ alkoxy)₂; P(=O)(C₁-C₄ alkoxy)₂; or S(=O)₂NR²²R²³;

 R^{22} is H or C_1-C_3 alkyl;

 \mathbb{R}^{23} is C_1 - C_4 alkyl; or phenyl optionally substituted with \mathbb{R}^{24} ; or

R²² and R²³ can be taken together along with the nitrogen atom to which they are attached to form a 4-morpholinyl, pyrrolidinyl, piperidinyl or imidazolyl ring;

 R^{25} is 1-2 halogen; C_1 - C_4 alkyl; C_1 - C_4 haloalkyl; C_1 - C_4 alkoxy; C_1 - C_4 haloalkoxy; nitro; cyano or C_1 - C_4 alkylthio; and

R²⁸ is halogen; cyano; nitro; hydroxy; hydroxy-carbonyl; C₁-C₆ alkyl; C₃-C₆ cycloalkyl; C₁-C₆ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkyl-sulfinyl; C₁-C₄ alkylsulfonyl; (C₁-C₄ alkyl)₃silyl; C₂-C₅ alkylcarbonyl; C₂-C₄ alkenyl; C₃-C₄ alkenyloxy; C₂-C₄ alkynyl; C₃-C₄ alkynyloxy; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₅ alkoxycarbonyl; C₂-C₄ alkoxyalkoxy; NR¹⁵R¹⁶; C(=0) NR¹⁷R¹⁸; or phenyl,

phenoxy or phenylthio each optionally substituted with ${\bf R}^{26}$.

provided that

when E is, C_1-C_6 alkylthio, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, phenoxy, phenylthio or phenylamino, then E may only substitute compounds of Formula I.

10. A fungicidal composition comprising a fungicidally effective amount of a compound of10 Formula I, II, III or IV

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wherein:

-G¹-G²-G³- taken together with the attached atoms form a 5-8 membered ring, wherein
-G¹- is -CR¹R⁷-; -(CHR¹CHR²)-; -(CHR¹CHR²CHR³)-; or -CHR¹CHR²CHR³CHR⁴)-;
-G²-is -O-; -S-; -S(O)-; -S(O)₂- or -NR²⁷-;

	$-G^3-is$ $-CR^4R^8-$; $-(CHR^5CHR^6)-$; $-(CHR^3CHR^5CHR^6)-$ or a
	direct bond;
	X is N or CR ¹³ ;
	Y is N or CR ¹⁴ ;
5	E is H; C ₁ -C ₆ alkyl; C ₃ -C ₇ cycloalkyl optionally
:	substituted with 1-2 methyl; C ₁ -C ₆ haloalkyl;
	C_1-C_6 alkylthio; C_1-C_6 alkoxy; C_1-C_6 haloalkox
	or phenyl, phenoxy, phenylthio, phenylamino,
,	phenylmethyl, indanyl, tetrahydronaphthalenyl
10	1-naphthalenyl, 2-naphthalenyl, thienyl,
•	furanyl or pyridyl each optionally substituted
	with R^{11} , R^{12} and R^{28} ;
	R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 and R^8 are each
	independently H; C ₁ -C ₄ alkyl; C ₁ -C ₄ haloalkyl,
15	halogen, CO ₂ CH ₃ , CO ₂ CH ₂ CH ₃ , cyano or phenyl
	optionally substituted with R25;
	provided that
	(i) the maximum number of carbon atoms in
•	$-G^1-G^2-G^3-$ with geminal disubstitution
20	is one;
	(ii) the maximum number of optionally
	substituted phenyl substituents on
	-G ¹ -G ² -G ³ - is one;
	(iii) $-G^3$ is other than a direct bond in
25	compounds of Formulae III and IV; and
	(iv) $-G^2-G^3$ is other than $-NR^{27}$ in
	compounds of Formulae I and II;
	\mathbb{R}^9 , \mathbb{R}^{10} and \mathbb{R}^{13} are each independently H; halogen;
	cyano; hydroxy; C ₁ -C ₆ alkyl; C ₁ -C ₄ haloalkyl;
30	C ₁ -C ₄ alkylthio; C ₁ -C ₄ alkylsulfinyl; C ₁ -C ₄
	alkylsulfonyl; C3-C6 cycloalkyl optionally
ru int	substituted with 1-2 methyl groups; C ₁ -C ₄
•.	alkoxy; C ₁ -C ₄ haloalkoxy; C ₂ -C ₄ alkoxyalkyl;
	C ₂ -C ₄ alkenyl; C ₂ -C ₄ haloalkenyl; C ₂ -C ₄
~ =	- 111

NR²⁹R³⁰; or phenyl or phenoxy optionally substituted with R31; or ${\bf R}^9$ and ${\bf R}^{13}$, or ${\bf R}^{10}$ and ${\bf R}^{13}$, or ${\bf R}^9$ and ${\bf R}^{14}$ can be taken together to form $-(CH_2)_3-$, $-(CH_2)_4-$ or a fused benzene ring optionally substituted with R31. R^{11} , R^{12} , R^{21} , R^{24} , R^{26} and R^{31} are each independently halogen; C1-C4 alkyl; C1-C4 haloalkyl; C₁-C₄ alkoxy; or C₁-C₄ haloalkoxy; \mathbb{R}^{14} is H; halogen; \mathbb{C}_1 - \mathbb{C}_2 alkyl; or \mathbb{C}_1 - \mathbb{C}_2 alkoxy; 10 R^{15} , R^{16} , R^{17} , R^{18} , R^{29} and R^{30} are each independently H or C₁-C₂ alkyl; or \mathbb{R}^{15} and \mathbb{R}^{16} , or \mathbb{R}^{17} and \mathbb{R}^{18} , or \mathbb{R}^{29} and \mathbb{R}^{30} can be taken together along with the nitrogen atom to 15 which they are attached to form a 4-morpholinyl, pyrrolidinyl or piperidinyl ring; \mathbb{R}^{20} and \mathbb{R}^{27} are each independently H; \mathbb{C}_1 - \mathbb{C}_4 alkyl; C1-C4 haloalkyl; C2-C5 alkylcarbonyl; phenylcarbonyl optionally substituted with R21; C3-C4 alkenyl; C3-C4 alkynyl; phenylmethyl optionally substituted with R21 on the phenyl ring; C1-C4 alkylsulfinyl; C1-C4 alkylsulfonyl; phenylsulfinyl, phenylsulfonyl or phenoxycarbonyl each optionally substituted with R21; C2-C4 25 alkoxycarbonyl; C(=0)NR²²R²³; C(=S)NHR²³; $P (=S) (C_1-C_4 \text{ alkoxy})_2; P (=0) (C_1-C_4 \text{ alkoxy})_2; or$ S (=0) 2NR22R23; is H or C_1-C_3 alkyl; 30 \mathbb{R}^{23} is \mathbb{C}_1 - \mathbb{C}_4 alkyl; or phenyl optionally substituted with R24; or \mathbb{R}^{22} and \mathbb{R}^{23} can be taken together along with the nitrogen atom to which they are attached to form a 4-morpholinyl, pyrrolidinyl, piperidinyl

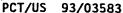
or imidazolyl ring;

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- R^{25} is 1-2 halogen; C_1 - C_4 alkyl; C_1 - C_4 haloalkyl; C_1 - C_4 alkoxy; C_1 - C_4 haloalkoxy; nitro; cyano or C_1 - C_4 alkylthio; and
- R²⁸ is halogen; cyano; nitro; hydroxy; hydroxy-carbonyl; C₁-C₆ alkyl; C₃-C₆ cycloalkyl; C₁-C₆ haloalkyl; C₁-C₄ alkylthio; C₁-C₄ alkyl-sulfinyl; C₁-C₄ alkylsulfonyl; (C₁-C₄ alkyl)₃silyl; C₂-C₅ alkylcarbonyl; C₂-C₄ alkenyl; C₃-C₄ alkenyloxy; C₁-C₄ alkynyloxy; C₁-C₄ alkoxy; C₁-C₄ haloalkoxy; C₂-C₄ alkoxyalkyl; C₂-C₅ alkoxycarbonyl; C₂-C₄ alkoxyalkoxy; NR¹⁵R¹⁶; C(=0)NR¹⁷R¹⁸; or phenyl, phenoxy or phenylthio each optionally substituted with R²⁶;
- 15 provided that.

when E is, C_1-C_6 alkylthio, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, phenoxy, phenylthio or phenylamino, then E may only substitute compounds of Formula I:

20 and agriculturally suitable salts and metal complexes thereof and at least one of (a) a surfactant, (b) an organic solvent and (c) at least one solid or liquid diluent.



International Application No L CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 C07D413/04; CO7D417/04; . A01N43/88 IL FIELDS SEARCHED Minimum Documentation Searched? Classification System Classification Symbols **C07D** Int.C1. 5 Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched III. DOCUMENTS CONSIDERED TO BE RELEVANT Category ° Citation of Document, 11 with Indication, where appropriate, of the relevant passages 12 Relevant to Claim No.13 P.A WO,A,9 211 249 (DU PONT DE NEMOURS) 1-10 9 July 1992 * claims * 1-10 CHEMICAL ABSTRACTS, vol. 83, 1975, Columbus, Ohio, US; abstract no. 10171 POTEKHIN, A. A., NIKOLAEVA, N. M. 15,6-Dihydro-4H-1,3,4-oxadiazines. see abstract & SU,A,461 929 28 February 1975 cited in the application later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the Special categories of cited documents: 10 "A" document defining the general state of the art which is not considered to be of particular relevance earlier document but published on or after the international "X" document of particular relevance; the claimed inventor cannot be considered novel or cannot be considered to involve an inventive step filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the focument is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "O" document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed "A" document member of the same patent family IV. CERTIFICATION Date of the Actual Completion of the International Search Date of Mailing of this International Search Report 13 JULY 1993 26. 07. 93 International Searching Authority Signature of Authorized Officer

Bernd Kissler

Form PCT/ISA/210 (second short) (Jamery 1985)

EUROPEAN PATENT OFFICE

Category a	NTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)	•
Category a	2410 CO(101022001 10 10 10 10 10 10 10 10 10 10 10 10	Relevant to Claim No.
	Citation of Document, with indication, where appropriate, of the relevant passages	
	OUTSTEAL ADSTDACTS VOT 90'	1-10
A	CHEMICAL ABSTRACTS, vol. 90,	• ••,
1	1979, Columbus, Ohio, US;	
1	abstract no. 152131,	•
1	DOVLATYAN V V; GEVORKYAN R A 'Synthesis of	
. [pesticides. Reactions of halomitriles with	•
ſ	esters of s-triazinyldithiocarbazic acid.	
	see abstract	
- 1. d	& ARM. KHIM. ZH. (AYKZAN, 05159628); 78;	
. 1	VOL.31 (11); PP.851-6	
.	VOL.31 (11), 11:002 0	
. 1	CHEMICAL ABSTRACTS, vol. 87,	1-10
١	CHEMICAL ADSTRACTS, VOI. 07,	
1	1977, Columbus, Ohio, US;	
1	abstract no. 102359,	
	DOVLATYAN V V; GEVORKYAN R A 'Synthesis of	
	pesticides. II. Study of the reaction of	
	potassium hydrazino-s-triazine with	•
	chloroacetonitrile and	,
· 1	.alpha.,.betadichloropropionitrile and	· •
- 1	its urotropine salt'	
	see abstract	•
1	& ARM. KHIM. ZH. (AYKZAN, 05159628); 77;	
1	VOL.30 (10); PP.851-4	• •
- 1	AOL'20 (10) * 11.031 +	s
	AUGUTAL ADCTDACTO val 90	1-10
	CHEMICAL ABSTRACTS, vol. 89,	
1	1978, Columbus, Ohio, US;	-
	abstract no. 43349,	
	DOVLATYAN V V; GEVORKYAN R A	•
•	'Oxadiazinyl-s-triazine derivatives'	
•]	see abstract	
	& SU,A,556 143 (ARMENIAN AGRICULTURAL	
	INSTITUTE; USSR)	· .
1	30 April 1977	-
.	20 Uhi i. 72	
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International application No.

PCT/US 93/03583

Box I	Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)	
This int	ternational search report has not been established in respect of certain claims under Article 17(2)(a) for the following reason	ns:
1.	Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely.	
2. 🗌	Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such	
	an extent that no meaningful international search can be carried out, specifically:	
	· · · · · · · · · · · · · · · · · · ·	
3.	Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).	•
Box II	Observations where unity of invention is lacking (Continuation of item 2 of first sheet)	
This Int	ernational Searching Authority found multiple inventions in this international application, as follows:	
	o	
1. 🗌	As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.	
, [As all searchable claims could be searches without effort justifying an additional fee, this Authority did not invite paymen	•
- [_	of any additional fee.	•
3. 🗌	As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:	
- 		
4.	No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:	
		-
Remark	on Protest The additional search fees were accompanied by the applicant's prote No protest accompanied the payment of additional search fees.	St.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)

International Application No. PCT/US93/03583

FURTHER INFORMATION CONTINUED FROM

The definition of the following substituent(s) is too general and/or encompasses too broad a range of totally different chemical groups, only partly supported by examples given in the descriptive part of the application:

X, Y, G1, G2, G3, E

The number of theoretically conceivable compounds resulting from the combination of all claimed substituents of above list precludes a comprehensive search. Guided by the spirit of the application and the inventive concept as disclosed in the descriptive part of the present application the search has been limited to the following case(s):

- 1. 4-(2-Pyridyl or 2-Pyrimidyl or 2-Triazinyl)-1,3,4-0xa/thiadiazines
 2. 4-(2-Pyridyl or 2-Pyrimidyl or 2-Triazinyl)-1,3,4-0xa/thiadiazepines
 3. 4-(2-Pyridyl or 2-Pyrimidyl or 2-Triazinyl)-1,3,4-0xa/thiadiazocines

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

9303583 SA 73324

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

The members are as contained in the European Patent Office EDP file on

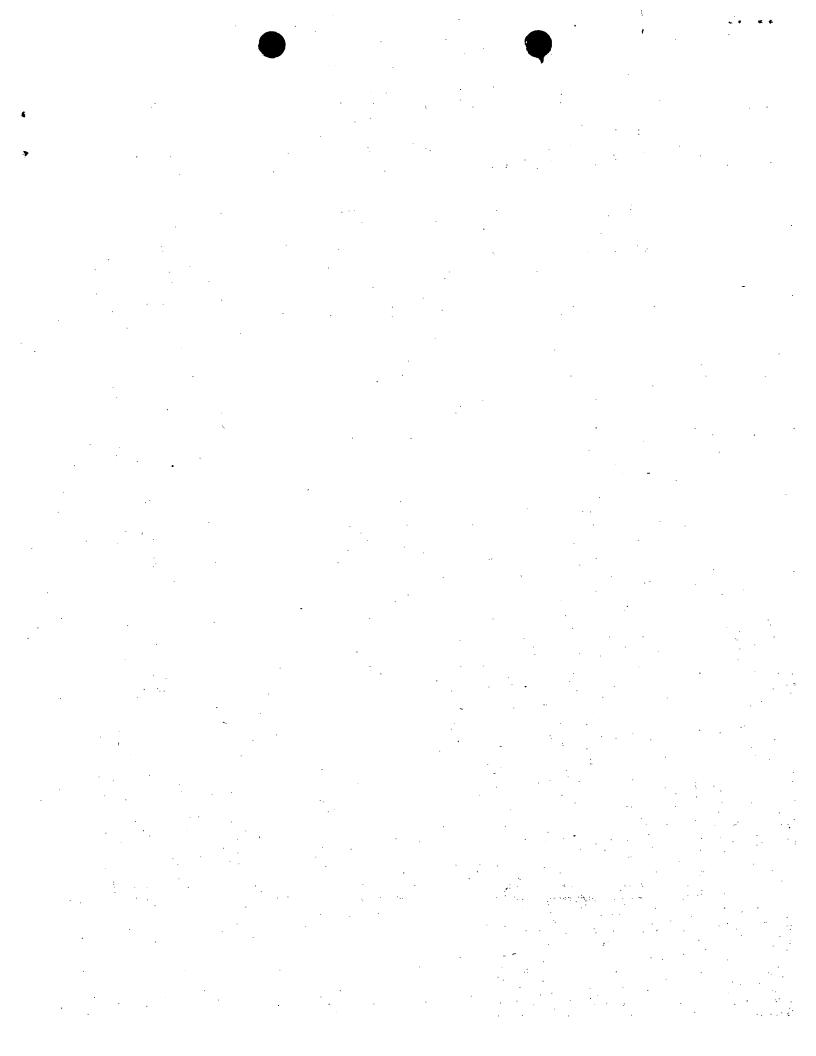
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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13/07/93

Patent document cited in search report	Patent document Publication date		Patent family member(s)	
WO-A-9211249	09-07-92	AU-A- CN-A-	9127091 1062726	Publication date 22-07-92 15-07-92
			•	
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For more details about this amnex : see Official Journal of the European Patent Office, No. 12/82



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